

Effective Data Modelling for Effective Data Visualization

DV07

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Capish



Consider...

Patients diagnosed with Cerebral Paresis experiencing Pain in thigh,
what aid are they using?

At the same time they are experiencing pain?

What other pain are they experiencing?

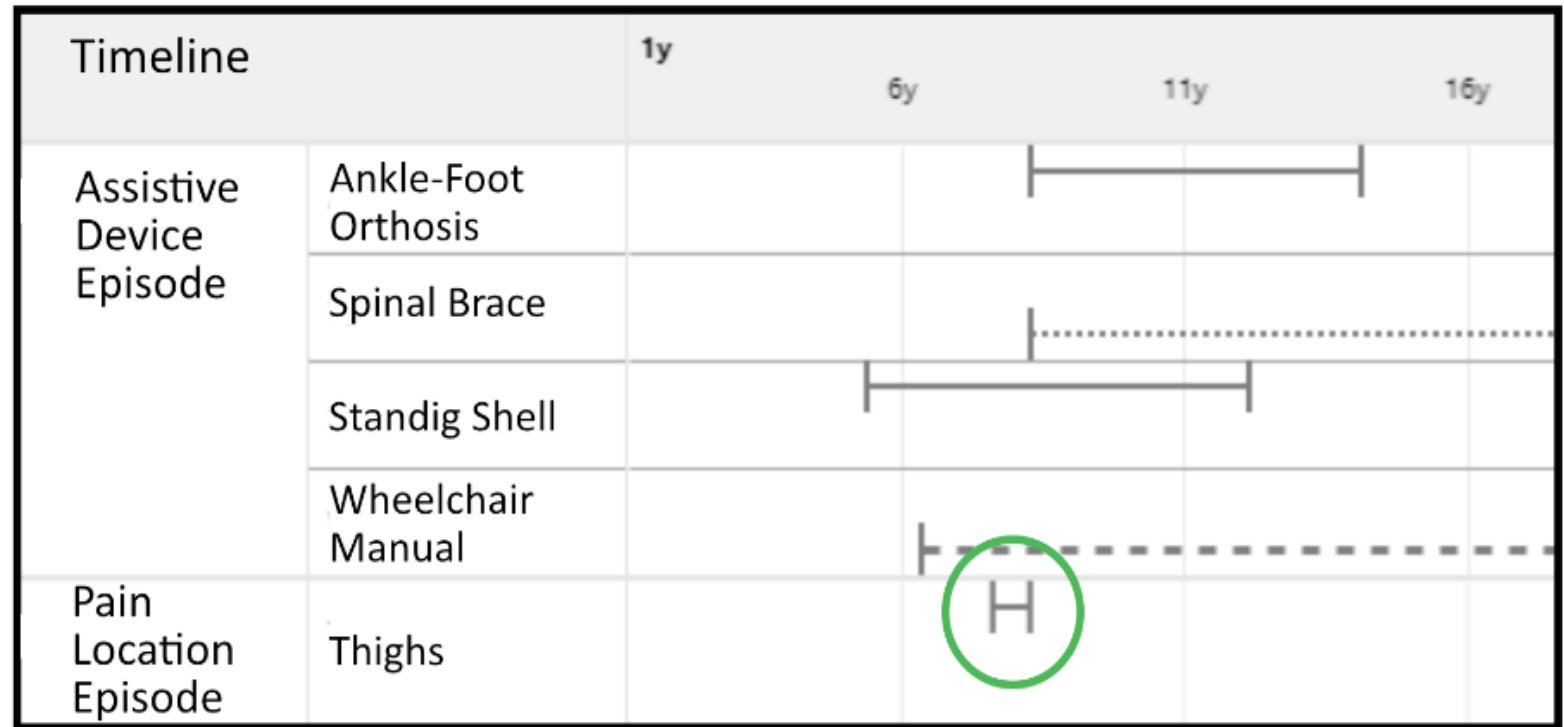
Understanding Cause and Effect

Pain Location Episode

Pain Location	Count
Thighs	1
Abdomen	0
Arms, Hands	0
Back	0

Assistive Device Episode

Assistive Device Subclass	Count
Wheelchair Manual	2
Ankle-Foot Orthosis	1
Spinal Brace	1
Standing Shell	1
Hip Orthosis	0
Knee Orthosis	0
Knee-Ankle-Foot Orthosis	0



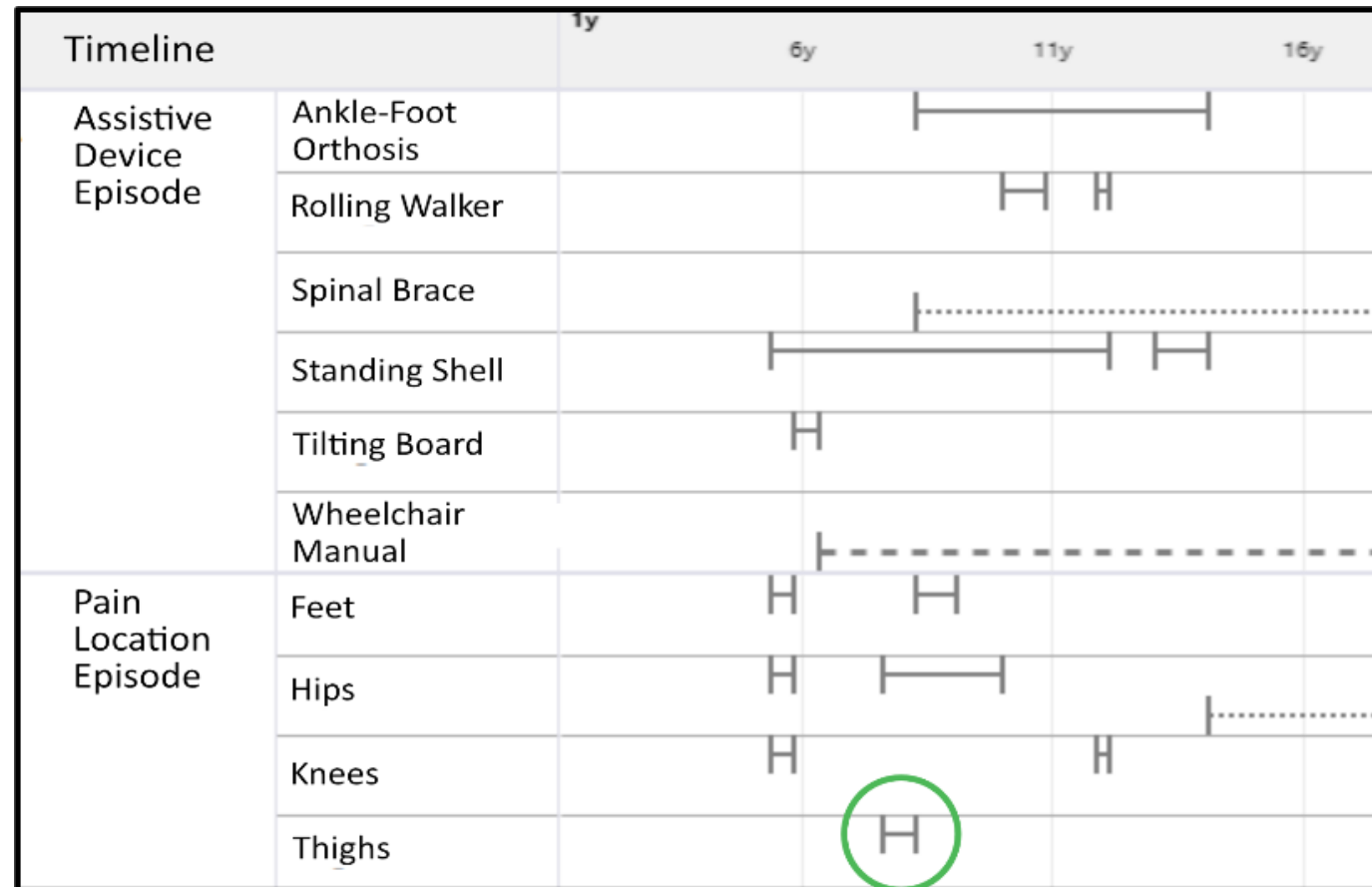
A Patient-Centric Approach

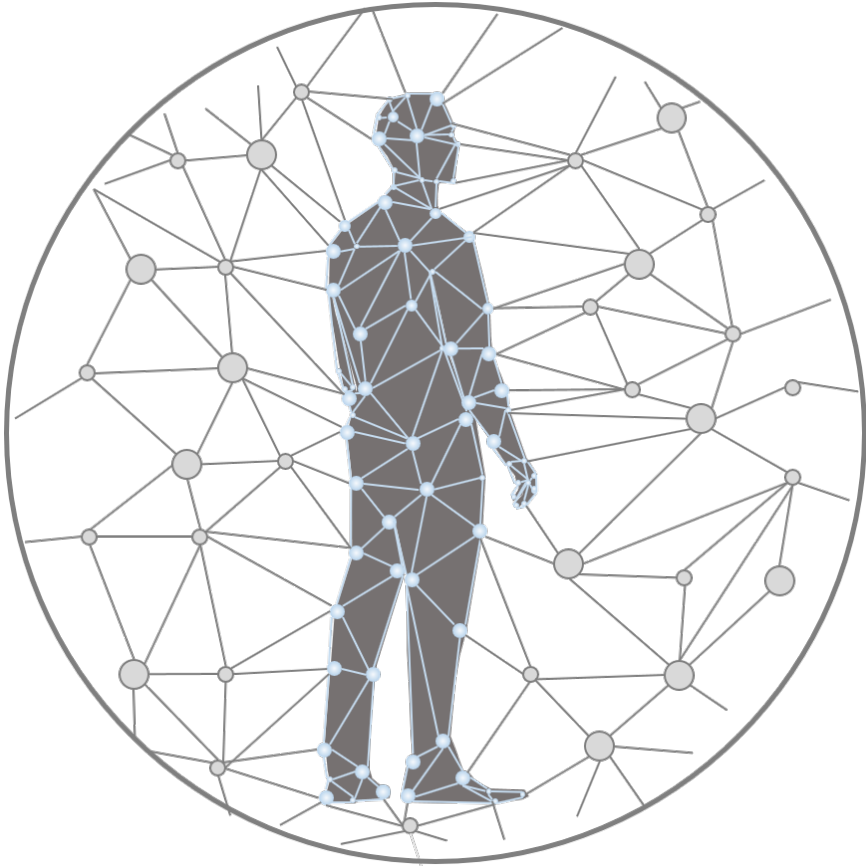
Pain Location Episode

Pain Location	Count
Hips	3
Feet	2
Knees	2
Thighs	1
Abdomen	0
Arms, Hands	0

Assistive Device Episode

Assistive Device Subclass	Count
Rolling Walker	2
Standing Shell	2
Wheelchair Manual	2
Ankle-Foot Orthosis	1
Spinal Brace	1
Tilting Board	1
Hip Orthosis	0
Knee Orthosis	0





Content

- Effective Visualization
- Information Modelling
- Exploiting the Model
- Case Study – A Collaboration Project
- More Examples
- Conclusion

EFFECTIVE VISUALIZATION

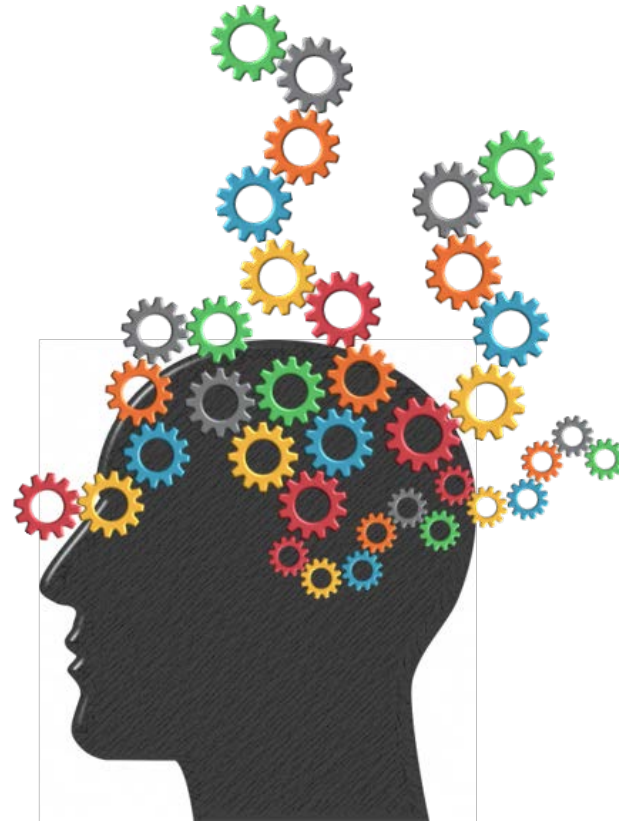
What does this mean?



Desired Effect

Purpose of Visualization

- Examining relationships
- Explore differences
- Visualizing patterns over time
- Identify and explore outliers
- Study subgroups



Longitudinal vs Cross-Sectional

Aggregate vs Individual

Multi-Purpose

Solution

Static Presentation

Guided Analytics

Self-Service Exploration

Flexibility



Data

Harmonized

Standardized

Contextualized

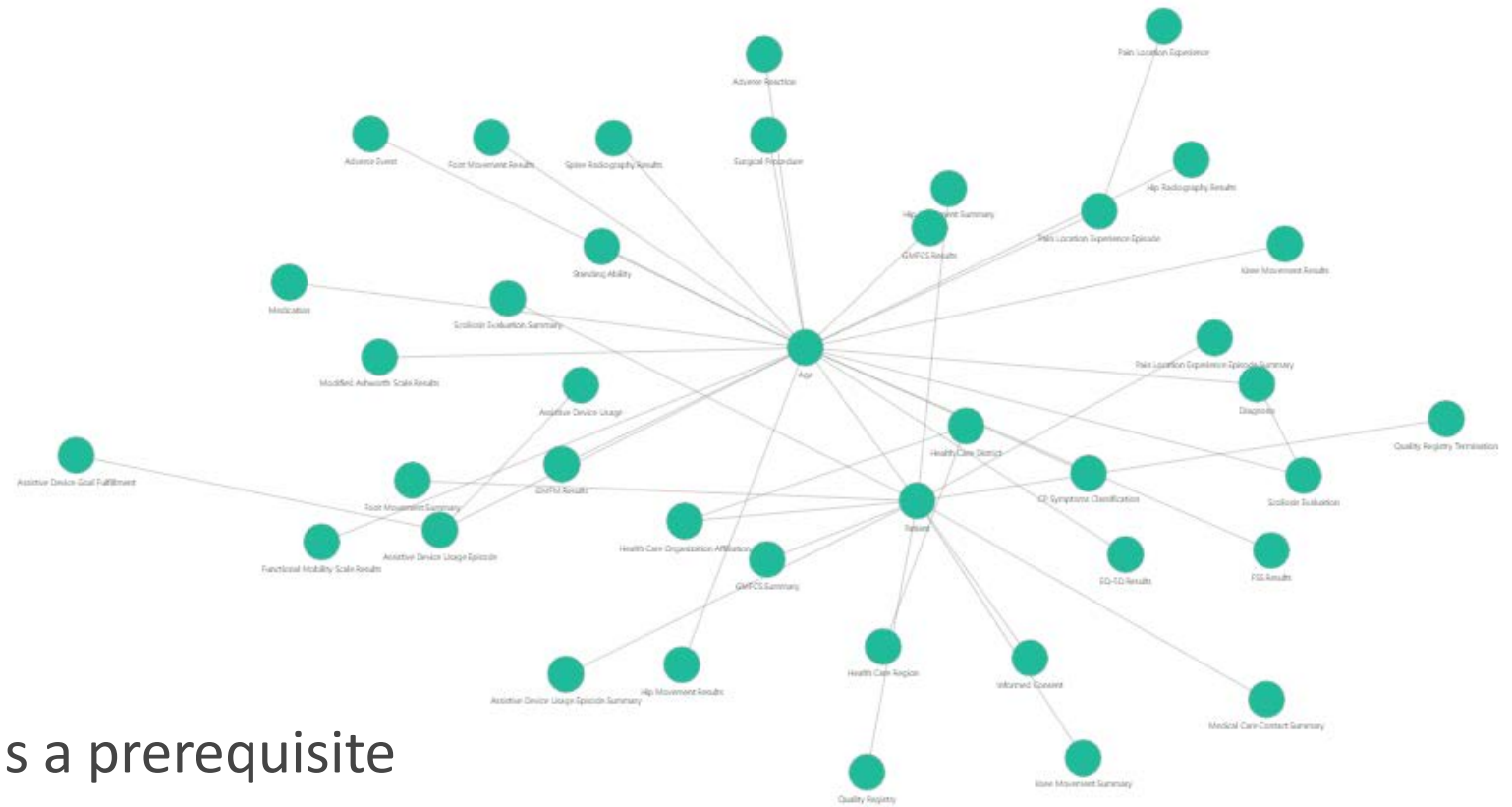
Objectivity

For the User

- Data access
- Proper functionality
- Understandable data

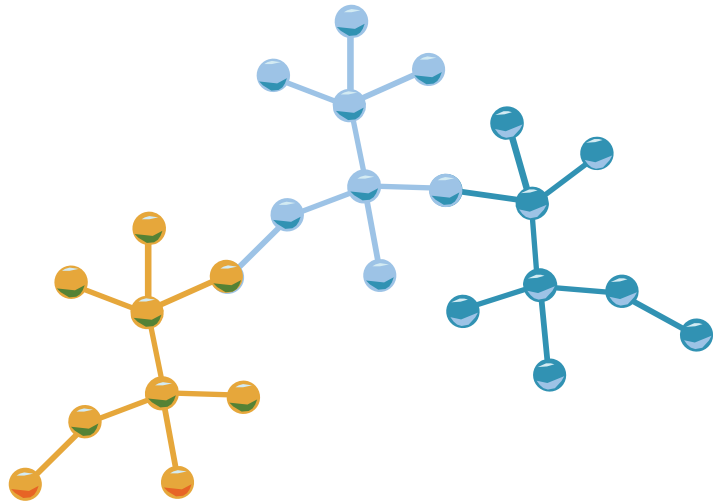


INFORMATION MODELLING



Objective data in context as a prerequisite
for efficient visualization

Harmonization and Standardization



- Naming and synonyms
- Data type and content scale
- Placement on timeline
- Comparable values (units) and language
- Standard value lists
- Classification relative reference
- Original values
- Notes
- Content validity

Capish Ontology - Contextualization



体重



Date = 2010-01-05
Weight = 150 pounds
Height = 69.29 inches
Systolic BP= 120 mmHg
Diastolic BP= 90 mmHg
Position = Sitting

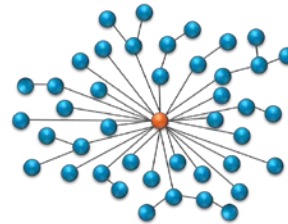


Datum = 2015-10-12
Vikt = 72 kg
Sys BP= 140 mm Hg
Dia BP= 110 mm Hg
Position = Liggande



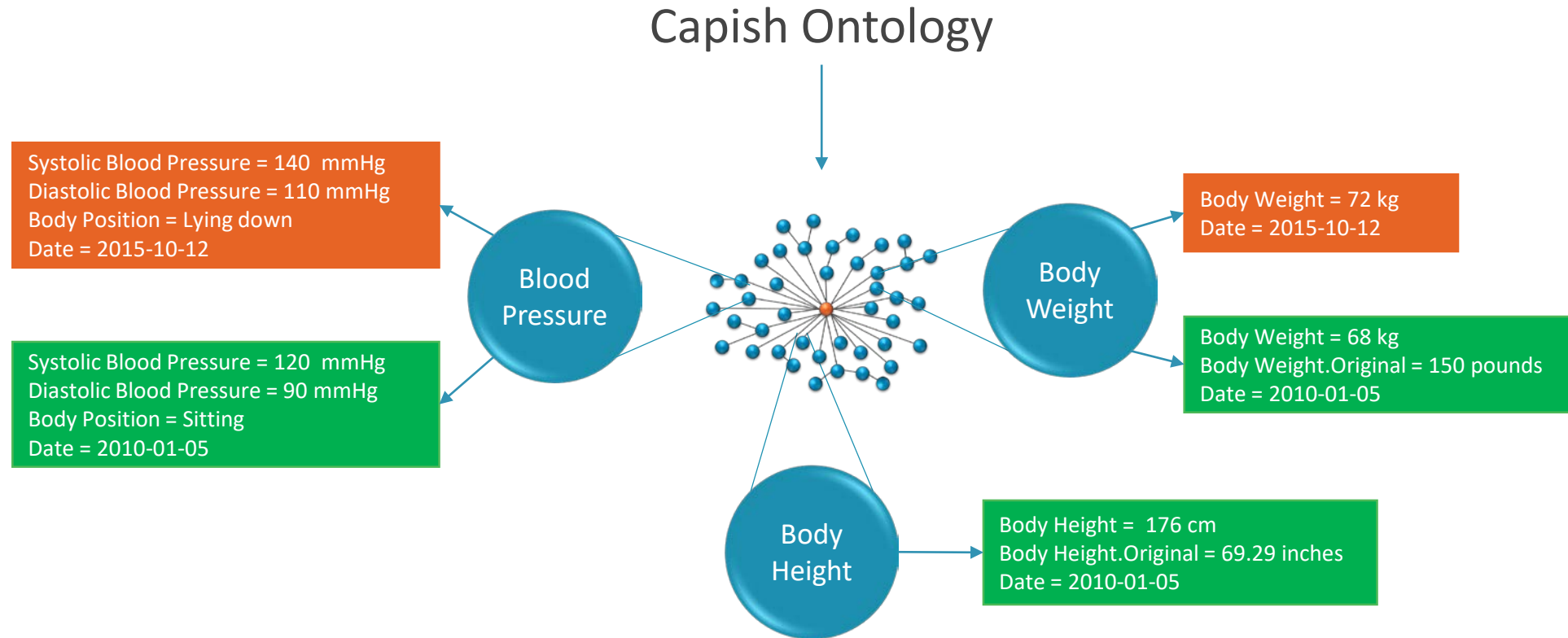
Weight

Capish Ontology

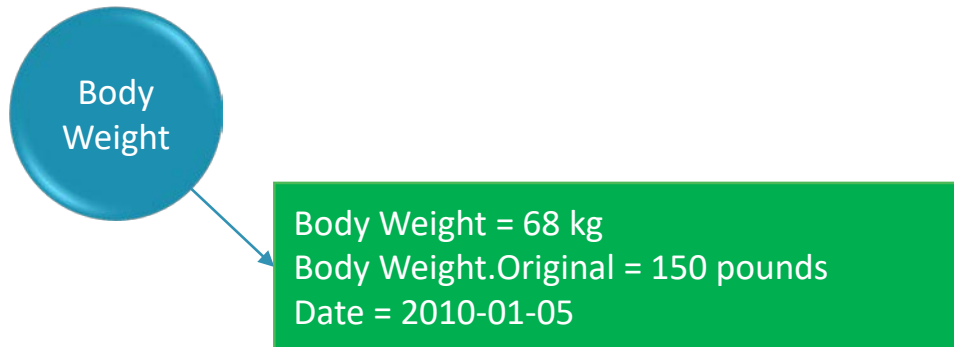


- Domain and Concept
- Specification
- Relations
- Roles
- Metadata and data

Medical Messages as Holons



One Holon in XML-format



Header

```
<o  
  holonType= "Body Weight.Results"  
  holonConcept="Body Weight"  
  dimension="Data"  
  domain="616.0754—dc23"  
  ontology="(G5.24.1.0).ClinSci.ontology@capish.se"  
  usage="Data"  
>  
<k>  
<f>Body Weight.Results Key<v>BodyWeightKey...</v></f>  
</k>
```

Message

```
<f>Date<v standard="ISO 8610" type="dateTime">2010-01-05</v></f>  
<f>Body Weight<v unit="kg">68</v></f>  
<f>Body Weight.Original<v unit="pounds">150</v></f>
```

Relation

```
<r  
  reverse="Has" dimension="Data" holonType="Patient">  
  Of  
<f>Patient Key<v>PatientKey...</v></f>  
</r>  
  
</o>
```

Holons are for Man and Machine

Message

```
<f>Date<v standard="ISO 8610" type="dateTime">2010-01-05</v></f>  
<f>Body Weight<v unit="kg">68</v></f>  
<f>Body Weight.Original<v unit="pounds">150</v></f>
```



Body Weight = 68 kg
Body Weight.Original = 150 pounds
Date = 2010-01-05

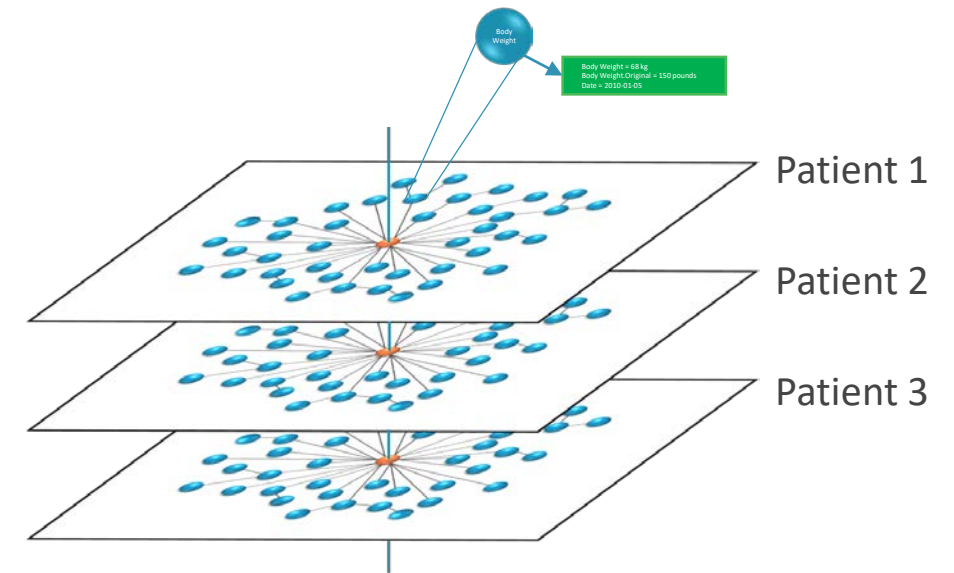
An Ontology Modelling the Real World

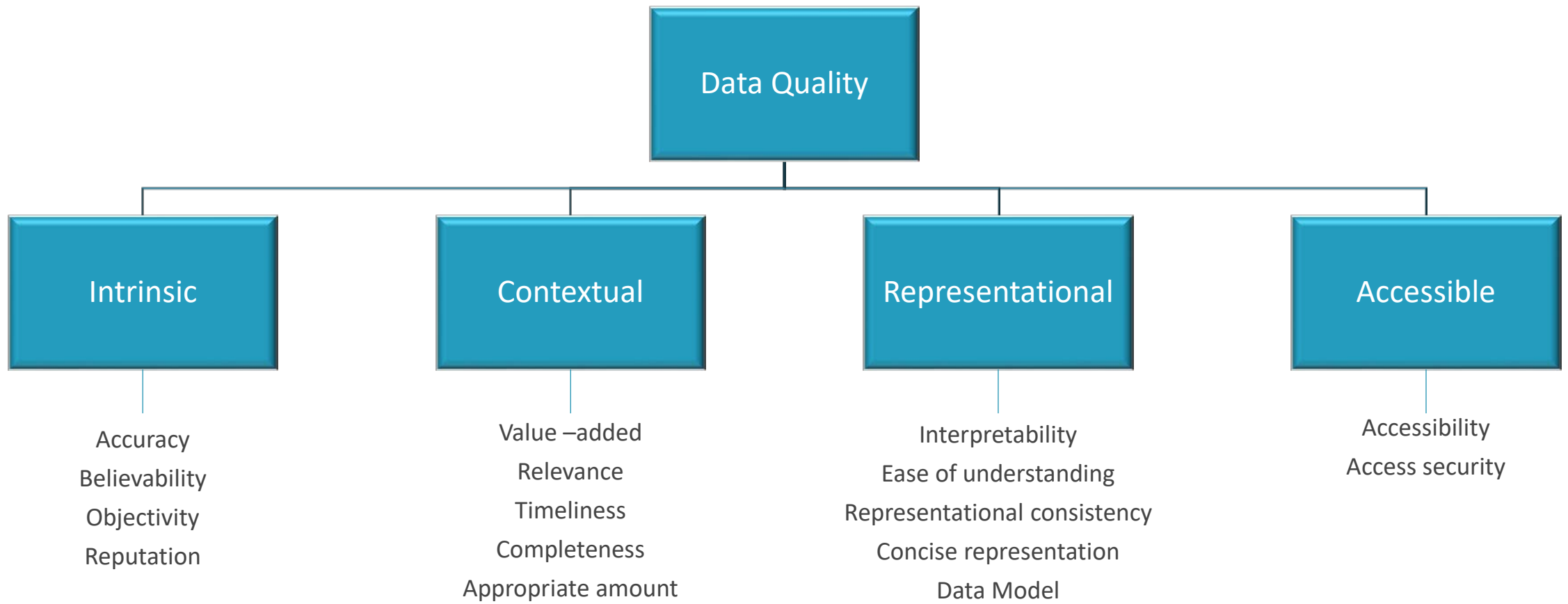
Formal representation of a knowledge domain describing

- its entities
- events and processes
- the relationships connecting these entities, events and processes

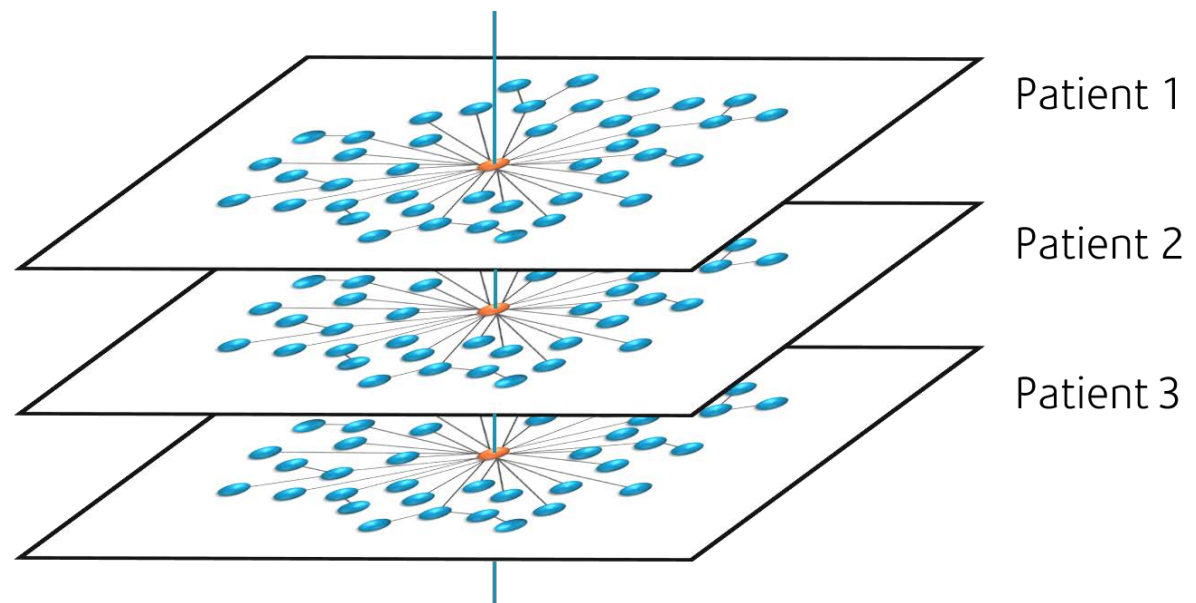
Benefits

- To share **common understanding** of the structure of information among people or software
- To enable **reuse** of domain knowledge
- To make domain assumptions **explicit**



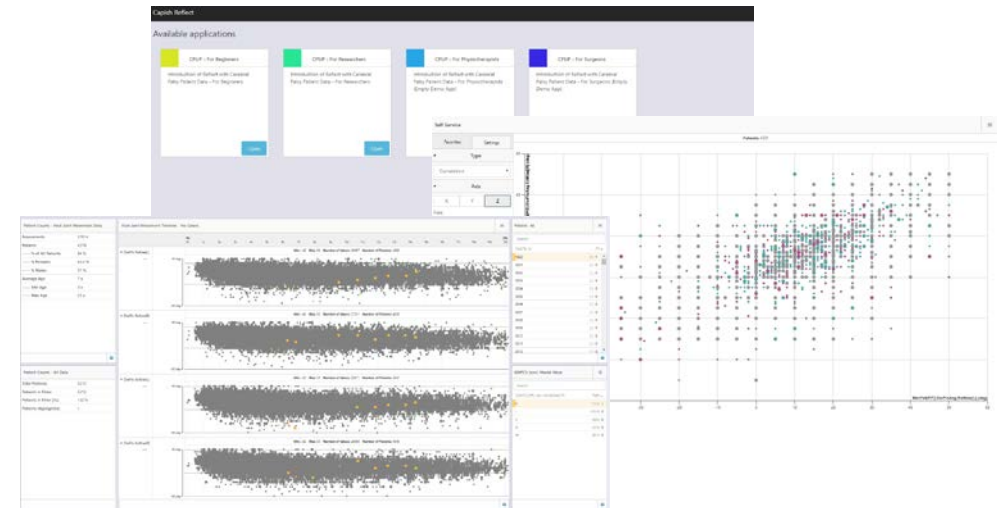


EXPLOITING THE MODEL

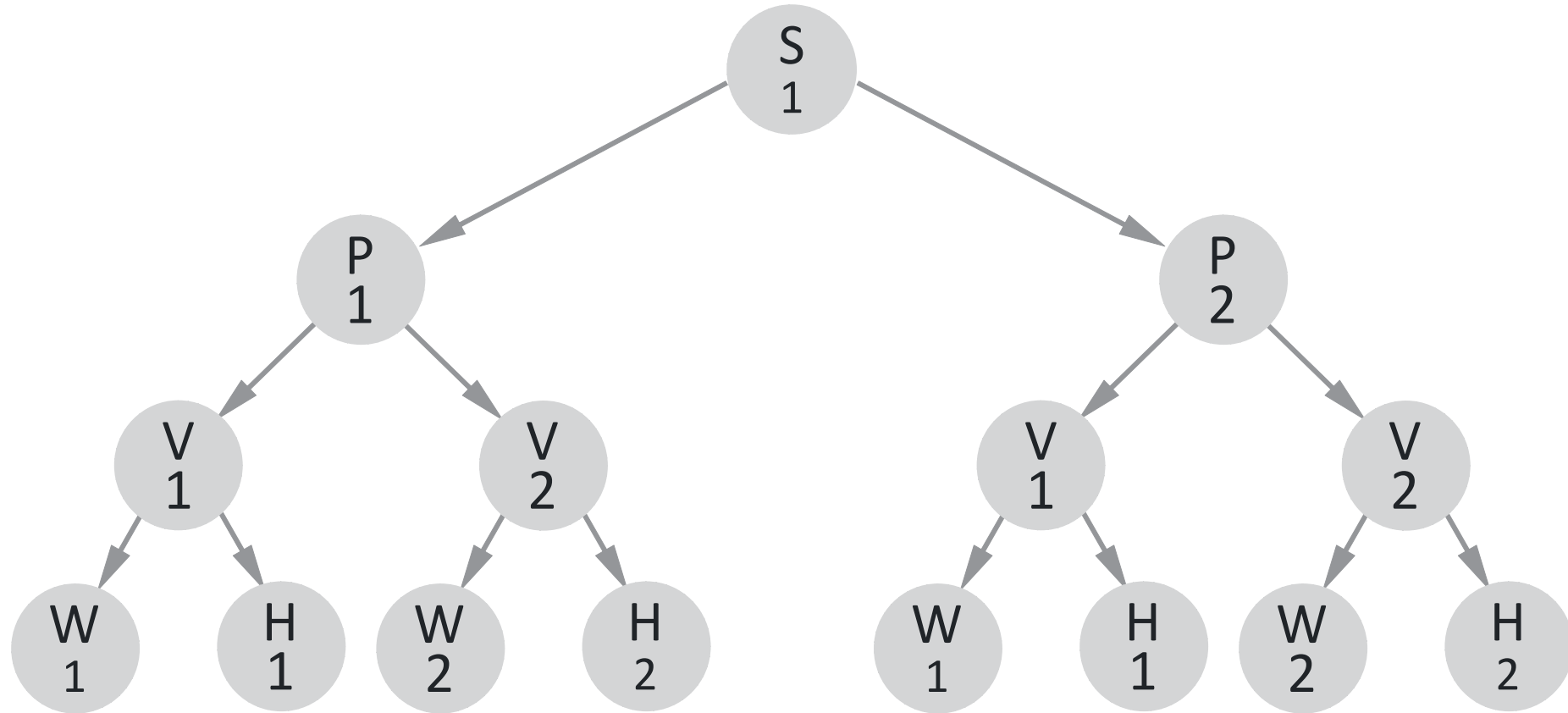


Opportunities in Visualization

- Application and graphics fit for different user groups
- Graphics based on data
- Selection of fields
- Free-text search with a context
- Exploration from different perspectives
- Full picture of a patient



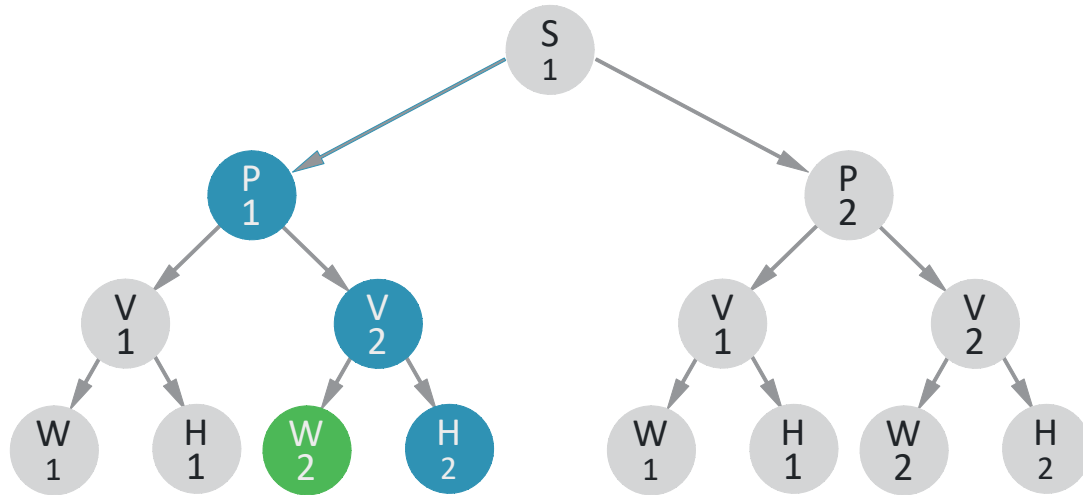
Database Structure



Reflective Logic

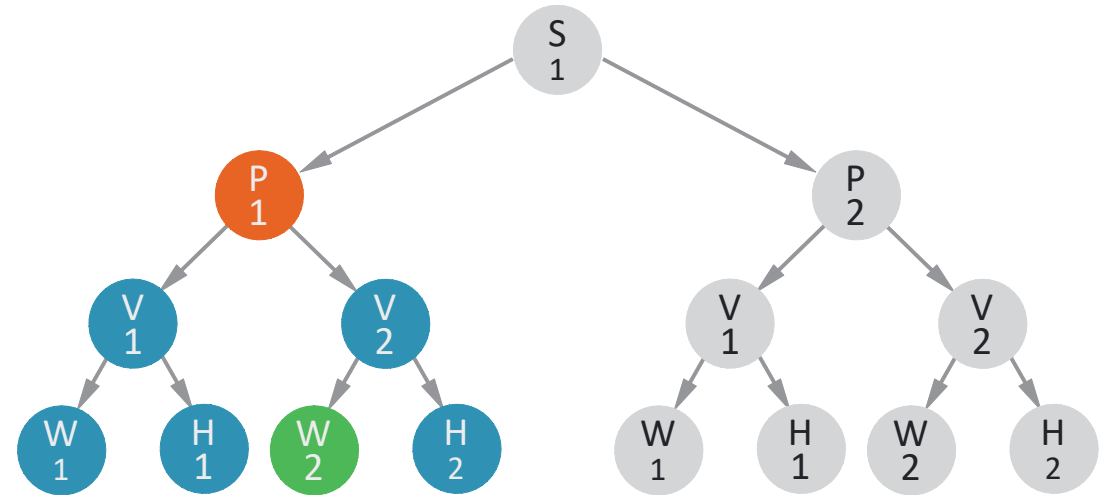
New paradigm on how to effectively query and retrieve information from datasets in an easy and flexible way

Without reflection



- = Holon matching query criteria
- = Reflection point Holon

With reflection in P



- = Holon in results
- = Holon not in results

CASE STUDY

- Follow-up surveillance program for people with cerebral palsy (CP)
- National Quality Register started in 1994
- Cooperative project between the pediatric orthopedics and child habilitation centers



Step 1: Ensure Accuracy



Data Quality Control

- Duplicate entries
- Conflicting answers
- Comments in result fields
- Differently spelled values
- Dates

Step 2: Make Comparable



Harmonization and Standardization

- Data was
 - standardized to ISO, ICD10 etc.
 - translated to a common language
 - compared to references
- A uniform terminology was used
- Common measurement units were ensured
- Coded values were mapped to understandable terms

Step 3: Set Structure



Contextualisation

- Data was
 - grouped into well-known concepts
 - appended with metadata
- Time was related to events for individual patients
- Episodes were created
- Summaries were created

For Different Users

Capish Reflect

Available applications

CPUP - For Beginners

Introduction of Reflect with Cerebral Palsy Patient Data - For Beginners

Open

CPUP - For Researchers

Introduction of Reflect with Cerebral Palsy Patient Data - For Researchers

Open

CPUP - For Physiotherapists

Introduction of Reflect with Cerebral Palsy Patient Data - For Physiotherapists (Empty Demo App)

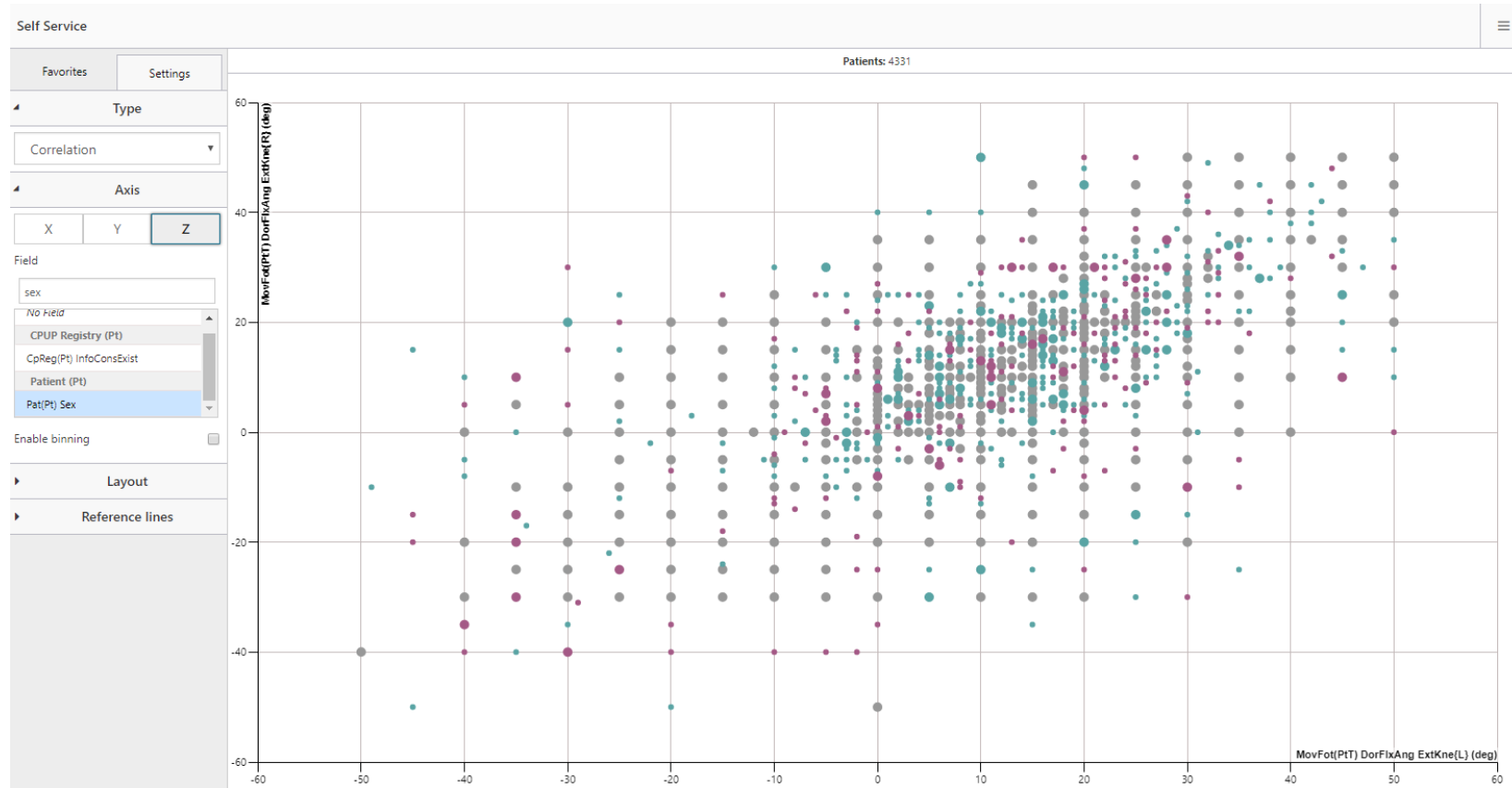
Open

CPUP - For Surgeons

Introduction of Reflect with Cerebral Palsy Patient Data - For Surgeons (Empty Demo App)

Open

Self-Service – Graphics and Field Selection



Free-Text Search in Context

Search

×

Search in: Applied filter

thigh

Q

Search results

▼ Pain Location Experience.Epi... 811 (674)

▼ Pain Location 811 (674)

Thighs 811 (674)

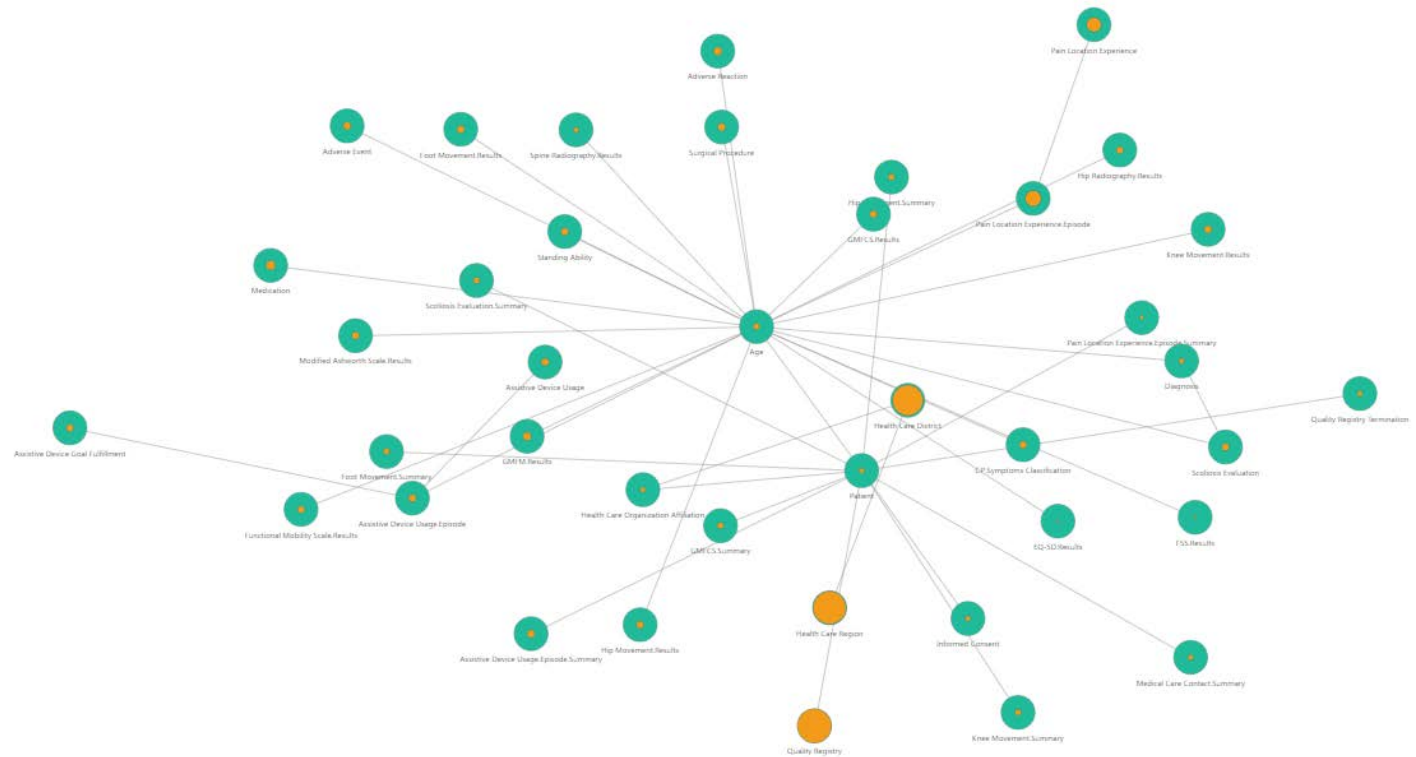
▼ Surgical Procedure 108 (86)

▼ Body Part 108 (86)

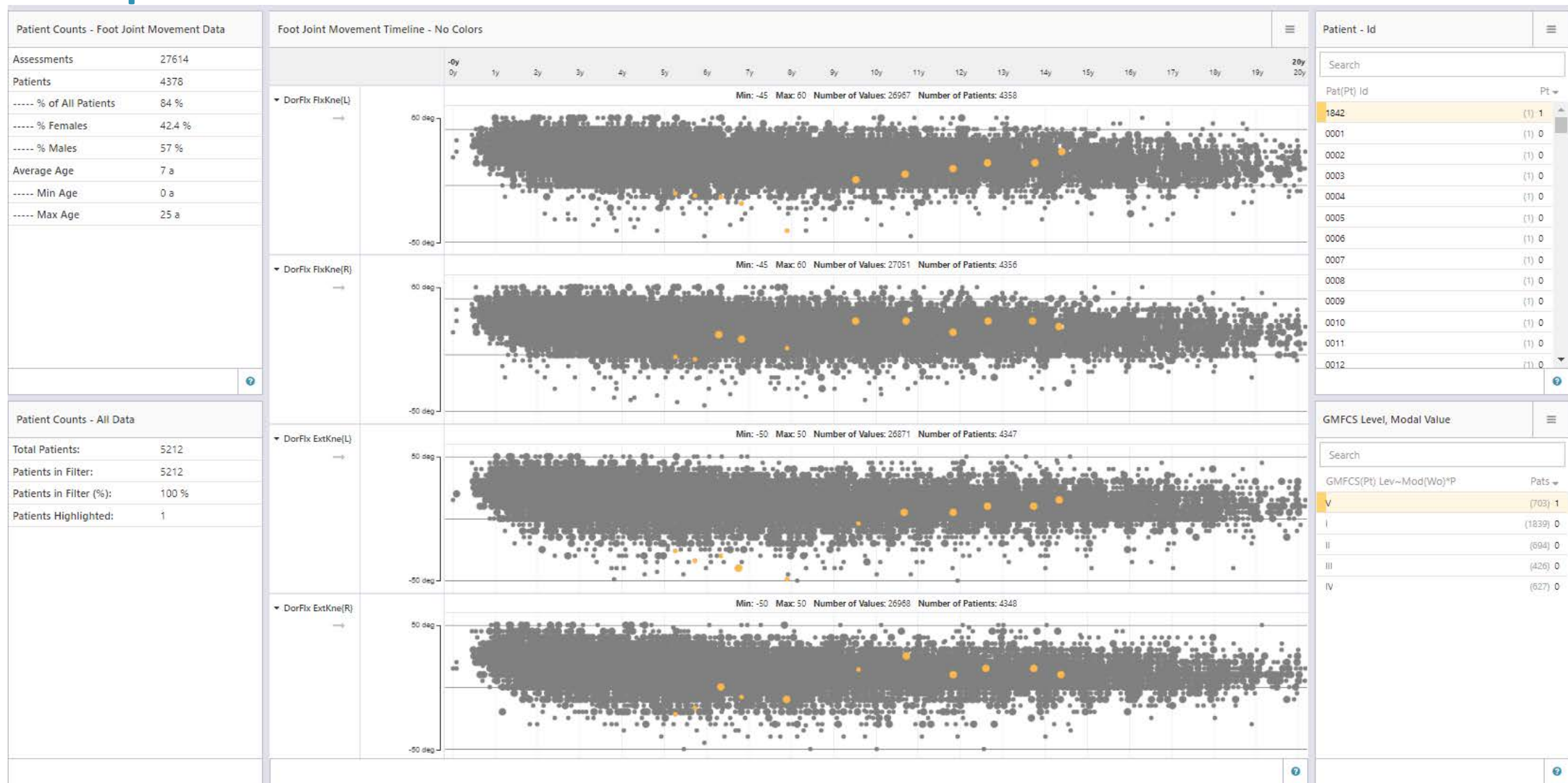
hip | thigh 91 (73)

hip joint | thigh 10 (10)

hip or thigh 7 (7)



Perspectives



Full Patient Record

Electronic Health Records: By Category

Disorder		2559 Male
Adverse Event	1	
CP Symptoms Classification	14	
Diagnosis	1	
Pain Location Experience.Episode	2	
Pain Location Experience.Episode.Summary	2	
Scoliosis Evaluation	13	
Scoliosis Evaluation.Summary	1	
Patient		
Age	11	
Health Care District	1	
Health Care Organization Affiliation	1	

MORE EXAMPLES

Patients on study drug in phase III program, with a specific AE, e.g. Headache, what medications are they taking? At the time of the AE or ever? Before or after?

What patients have ever had cancer?

Identify similar patients, e.g. responders in same age group and sex, with same AE. Toggle between patients and explore differences.

Find an outlier, and have immediate access to all their data.

Conclusion: Achieving the Desired Effect

- Understand the purpose
- Ensure access to quality data
- Apply effective data model
- Exploit the model with appropriate technology





Thank You!



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