

Use of Semantic Web Technologies as a Driver to Improve the Performance of Health Economic Modelers

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**Políticas públicas para la salud:
perspectivas desde la economía y la sanidad**



Background

- Where we started from

Semantic web technologies

- What inspired us

RaDiOS

- What we have done so far

OSDi

- What we will be able to do in the future



Background

Coste-efectividad del
cribado neonatal de la
hiperplasia
suprarrenal congénita

Informes de Evaluación
de Tecnologías Sanitarias
SESCS

INFORMES, ESTUDIOS E INVESTIGACIÓN



Once upon a time...

Documento marco sobre cribado
poblacional



PONENCIA DE CRIBADO POBLACIONAL
DE LA COMISION DE SALUD PUBLICA

Coste-efectividad del
cribado neonatal de la
fibrosis quística en
España

Informes de Evaluación
de Tecnologías Sanitarias
SESCS

INFORMES, ESTUDIOS E INVESTIGACIÓN



Análisis coste-
efectividad del
cribado neonatal de la
enfermedad de células
falciformes

Informes de Evaluación
de Tecnologías Sanitarias
SESCS

INFORMES, ESTUDIOS E INVESTIGACIÓN



Coste-efectividad del
cribado ampliado de
errores congénitos del
metabolismo mediante
espectrometría de
masas en tándem

Informes de Evaluación
de Tecnologías Sanitarias
SESCS

INFORMES, ESTUDIOS E INVESTIGACIÓN



Análisis coste-
efectividad del
cribado neonatal de la
deficiencia de
biotinidasa

Informes de Evaluación
de Tecnologías Sanitarias
SESCS

INFORMES, ESTUDIOS E INVESTIGACIÓN



Coste-efectividad del
cribado neonatal de la
tirosinemia tipo I

Informes de Evaluación
de Tecnologías Sanitarias
SESCS

INFORMES, ESTUDIOS E INVESTIGACIÓN



Background

Cost-effectiveness of newborn screening for Disease X

1

Posing the
research question

Is the newborn screening for **disease X** cost –
effective from the perspective of the NHS?

Cost-effectiveness of newborn screening for Disease X

1

research question

Disease X = homocystinuria

Disease X = VLCAD

Disease X = isovaleric acidemia

Disease X = MCAD

Disease X = methylmalonic acidemia

Disease X = biotinidase deficiency

Disease X = propionic acidemia

Disease X = MSUD

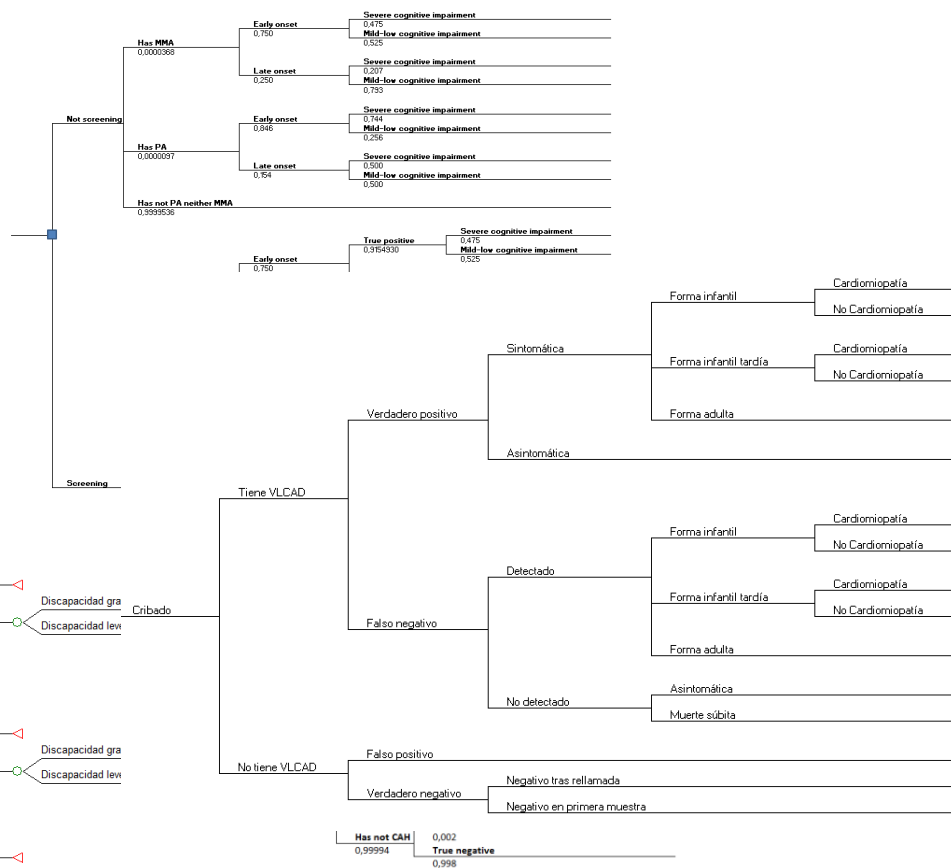
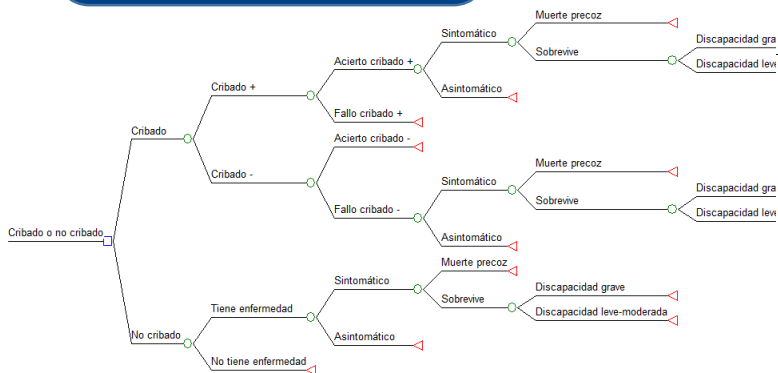
screening for **disease X** cost –
effective from the perspective of the NHS?

1

Posing the research
question

2

Defining (and
validating) the
conceptual model



1

Posing the research
question

2

Defining (and
validating) the
conceptual model

3

Collecting and
synthesizing
evidence

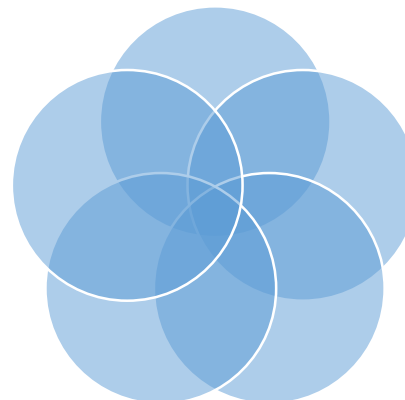
Scarce
evidence

Difficulties
to access

Low
quality

Risk of
bias

Lack of
methods



1

Posing the research question

2

Defining (and validating) the conceptual model

3

Collecting and synthesizing evidence

4

Implementation

5

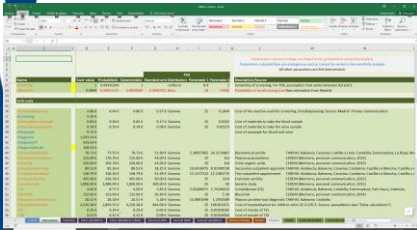
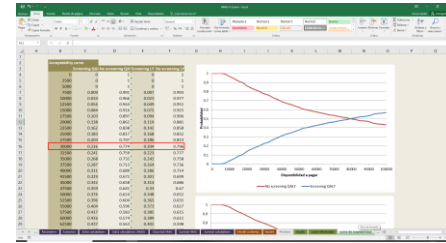
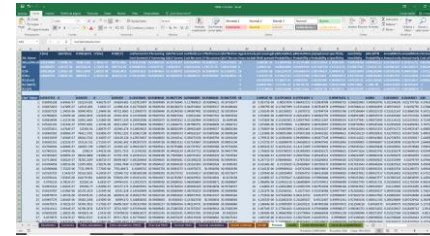
Validation

6

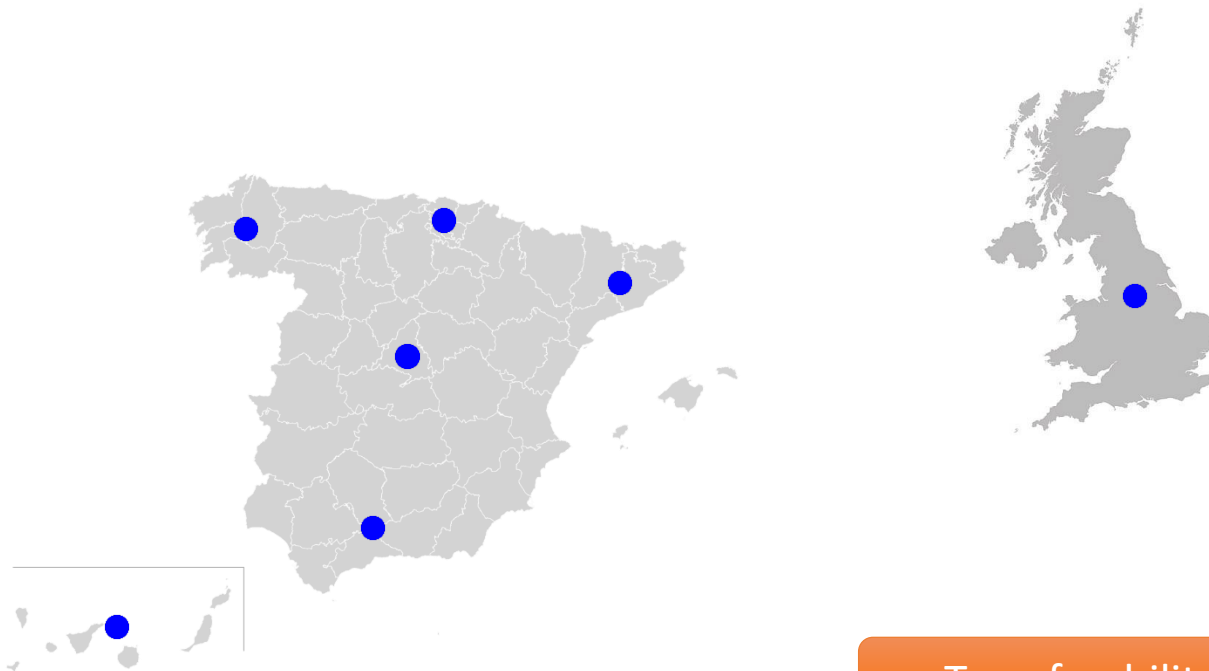
Running experiments and collecting results

7

Analyzing results, discussion and recommendations







Transferability!



Semantic web technologies

Extension of
standards for the
web...

... to make
Internet data
machine-readable

Standardization

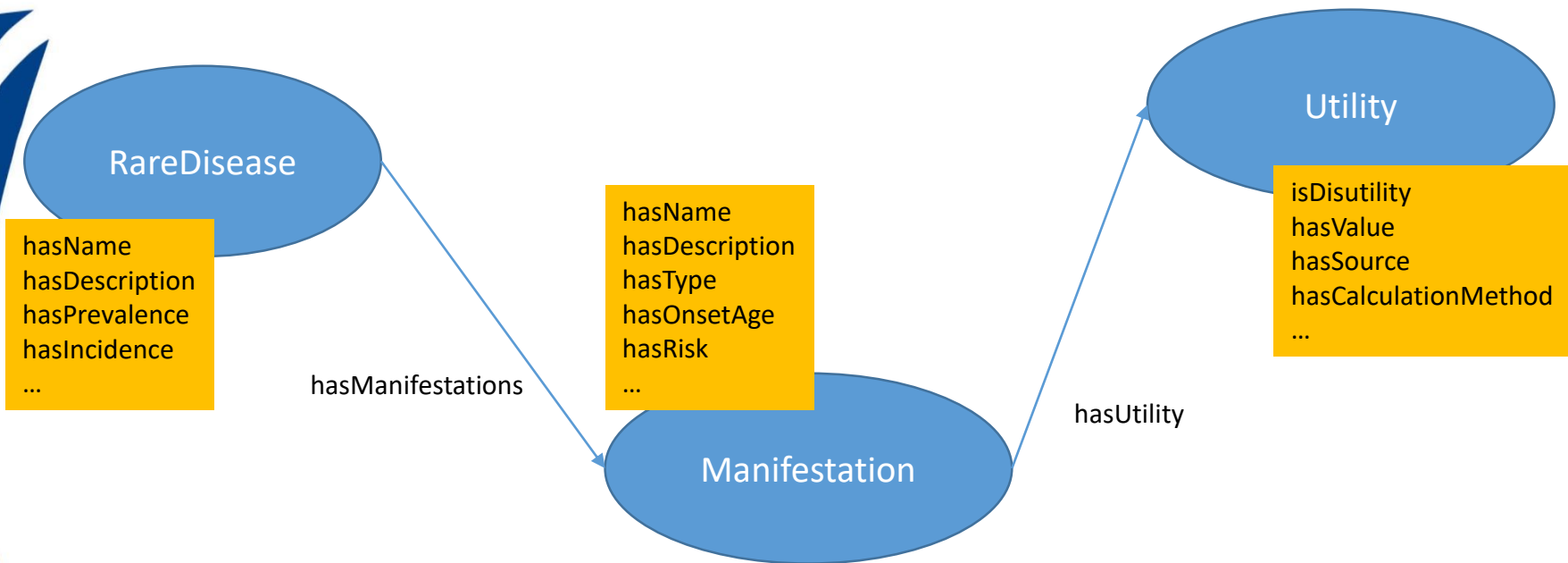
Extensibility

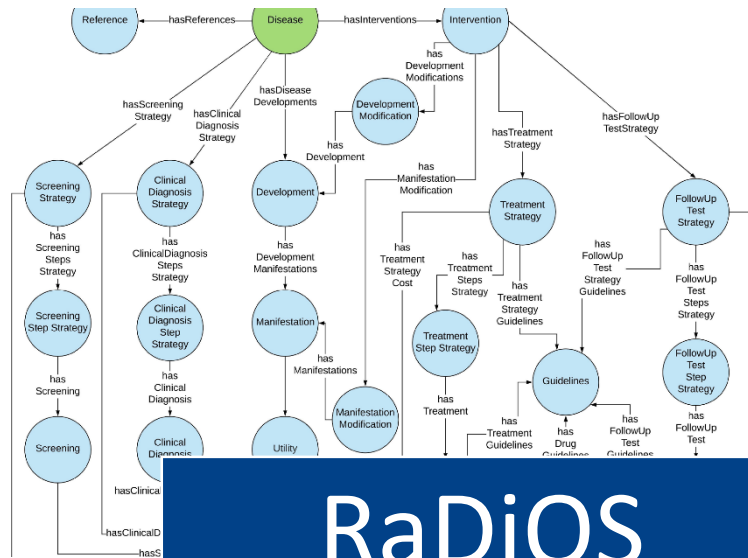
Ontologies!

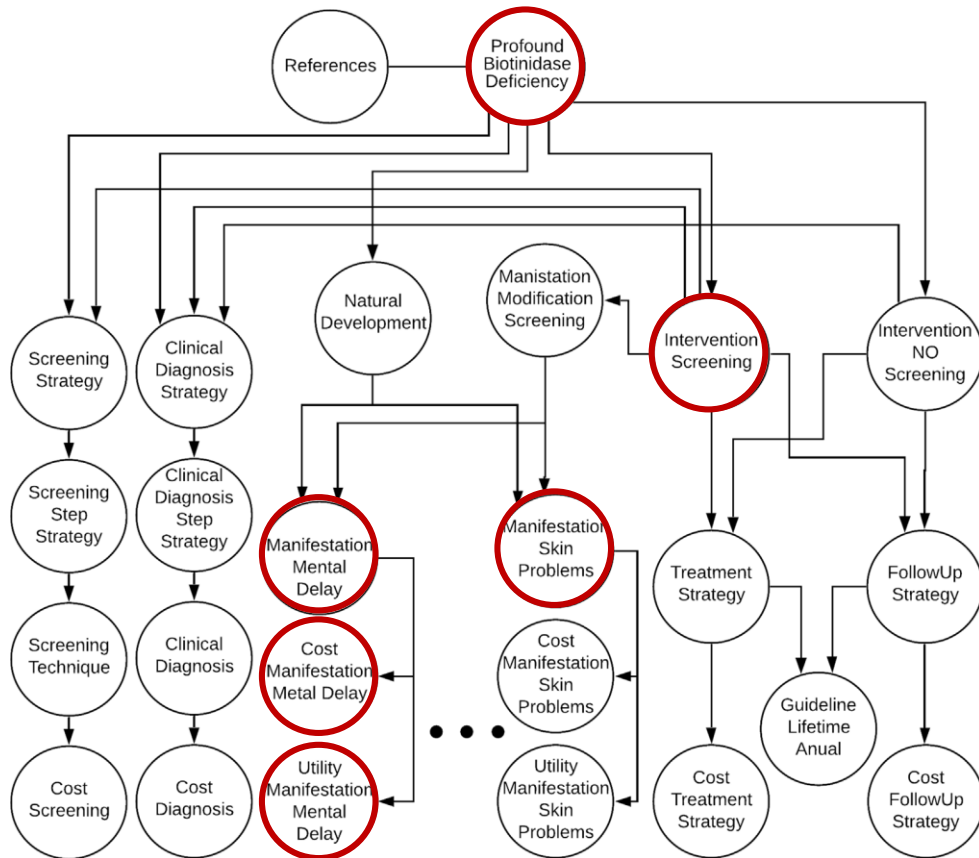
Inference

Interoperability









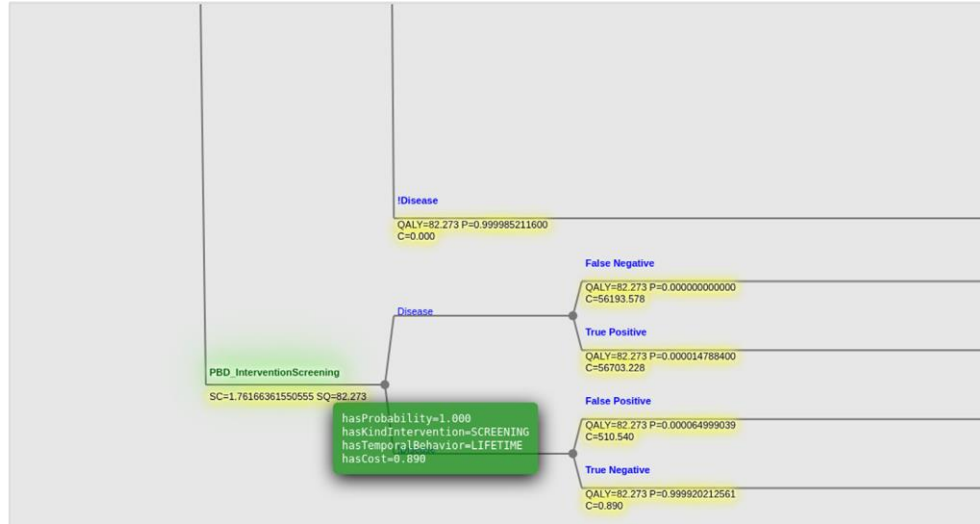
INPUT PARAMETERS

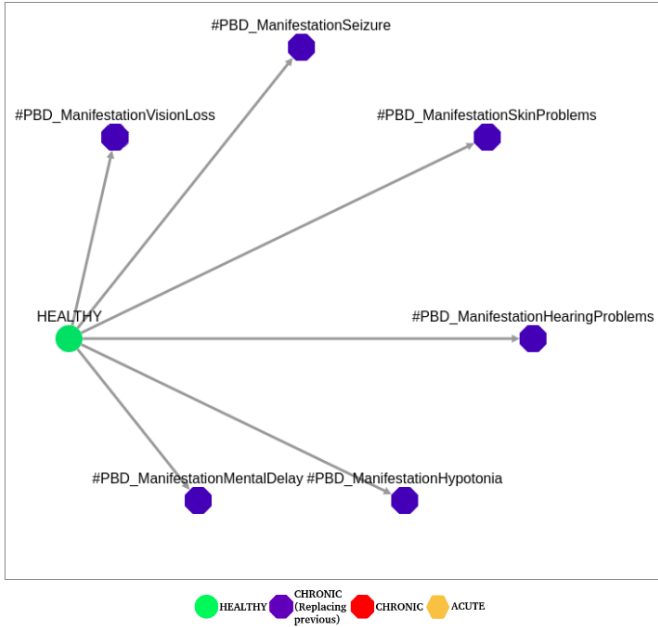
PBD_ProfoundBiotinidaseDeficiency ▼
 PBD_InterventionNoScreening ▼
 PBD_InterventionScreening ▼
 PBD_ClinicalDiagnosisStrategy ▼

Generate Decision Tree

Discount rate (Costs):	0.0
Discount rate (Effects):	0.0
Utility general population:	1.0

C = COSTS, P = PROBABILITY, SC = SUMMARY COSTS, SQ = SUMMARY QALYS





SECOND ORDER PARAMETERS		
NAME	VALUE	DISTRIBUTION
P_BIRTH_PREVALENCE	1.47884E-5	Beta (8.0, 540955.0)
P_DIAG_#PBD_ManifestationHearingProblems	1.0	Constant (1.0)
P_DIAG_#PBD_ManifestationHypotonia	1.0	Constant (1.0)
P_DIAG_#PBD_ManifestationMentalDelay	1.0	Constant (1.0)
P_DIAG_#PBD_ManifestationSeizure	1.0	Constant (1.0)
P_DIAG_#PBD_ManifestationSkinProblems	1.0	Constant (1.0)
P_DIAG_#PBD_ManifestationVisionLoss	1.0	Constant (1.0)
P_NONE_#PBD_ManifestationHearingProblems	0.515	Beta (65.0, 61.0)
P_NONE_#PBD_ManifestationHypotonia	0.457	Beta (17.0, 20.0)
P_NONE_#PBD_ManifestationMentalDelay	0.557	Beta (14.0, 6.0)
P_NONE_#PBD_ManifestationSeizure	0.564	Beta (65.0, 50.0)
P_NONE_#PBD_ManifestationSkinProblems	0.41	Beta (24.0, 34.0)
P_NONE_#PBD_ManifestationVisionLoss	0.175	Beta (19.0, 91.0)
C_#PBD_ClinicalDiagnosisStrategy	509.65	Uniform (409.65, 609.65)
C_#PBD_FollowUpStrategy	616.75672	Constant (616.75672)
C_#PBD_ManifestationHearingProblems	155.14	Gamma (24.999999999999996, 6.2056000000000004)
C_#PBD_ManifestationMentalDelay	217.74	Gamma (24.999999999999996, 8.7096000000000002)
C_#PBD_ManifestationVisionLoss	121.86	Gamma (24.999999999999996, 4.8744000000000005)
C_#PBD_TreatmentStrategy	66.2475	Constant (66.2475)
TC_#PBD_ManifestationHearingProblems	31169.95	Gamma (24.999999999999996, 1246.79800000000002)
TC_#PBD_ManifestationHypotonia	3665.56	Gamma (24.999999999999996, 146.62240000000003)
TC_#PBD_ManifestationMentalDelay	1218.02	Gamma (24.999999999999996, 48.72080000000001)
TC_#PBD_ManifestationSeizure	3665.56	Gamma (24.999999999999996, 146.62240000000003)
TC_#PBD_ManifestationSkinProblems	3665.56	Gamma (24.999999999999996, 146.62240000000003)
TC_#PBD_ManifestationVisionLoss	251.8	Gamma (24.999999999999996, 10.072000000000003)
DU_#PBD_ManifestationHearingProblems	0.01	Uniform (0.008, 0.012)
DU_#PBD_ManifestationMentalDelay	0.07	Uniform (0.056, 0.084)
DU_#PBD_ManifestationSeizure	0.04	Uniform (0.032, 0.048)
LER_#PBD_ManifestationMentalDelay	9.6	Gamma (25.0, 0.38)

Common elements among manifestations

Select disease

PBD_ProfoundBiotinidaseDeficiency

Select development

PBD_NaturalDevelopment

Select intersection element

Treatment_Strategy

Show manifestations intersection

Inference!

Show manifestations intersection

	disease	development	manifestation	↓ treatment
10	PBD_ProfoundBiotinidaseDeficiency	PBD_NaturalDevelopment	PBD_SeizureManifestation	PBD_FakeTreatmentStrategy
7	PBD_ProfoundBiotinidaseDeficiency	PBD_NaturalDevelopment	PBD_MentalDelayManifestation	PBD_FakeTreatmentStrategy
2	PBD_ProfoundBiotinidaseDeficiency	PBD_NaturalDevelopment	PBD_SkinProblemsManifestation	PBD_FakeTreatmentStrategy
13	PBD_ProfoundBiotinidaseDeficiency	PBD_NaturalDevelopment	PBD_HearingProblemsManifestation	PBD_BiotinTreatmentStrategy
11	PBD_ProfoundBiotinidaseDeficiency	PBD_NaturalDevelopment	PBD_VisionLossManifestation	PBD_BiotinTreatmentStrategy
8	PBD_ProfoundBiotinidaseDeficiency	PBD_NaturalDevelopment	PBD_SeizureManifestation	PBD_BiotinTreatmentStrategy
5	PBD_ProfoundBiotinidaseDeficiency	PBD_NaturalDevelopment	PBD_MentalDelayManifestation	PBD_BiotinTreatmentStrategy
3	PBD_ProfoundBiotinidaseDeficiency	PBD_NaturalDevelopment	PBD_HypotoniaManifestation	PBD_BiotinTreatmentStrategy
0	PBD_ProfoundBiotinidaseDeficiency	PBD_NaturalDevelopment	PBD_SkinProblemsManifestation	PBD_BiotinTreatmentStrategy

Parameters whose geographical context is within the European Union

Select study ID

PBD_001

Show european parameters

Inference!

Show european parameters

	parameterType	parameter	studyIdentifier	parameterCountry	countryLabel
0	Utility	PBD_SkinProblemsManifestationUtility	PBD_001	Spain	Spain
1	Utility	PBD_HypotoniaManifestationUtility	PBD_001	Spain	Spain
2	Utility	PBD_HearingProblemsManifestationUtility	PBD_001	Spain	Spain
3	Utility	PBD_MentalDelayManifestationUtility	PBD_001	Spain	Spain
4	Utility	PBD_BasePopulationUtility	PBD_001	Spain	Spain
5	Utility	PBD_SeizureManifestationUtility	PBD_001	Spain	Spain
6	Utility	PBD_VisionLossManifestationUtility	PBD_001	Spain	Spain
7	Cost	PBD_SkinProblemsManifestationCost	PBD_001	Spain	Spain
8	Cost	PBD_HearingProblemsManifestationCost	PBD_001	Spain	Spain
9	Cost	PBD_ScreeningCost	PBD_001	Spain	Spain

Inference!

Disease

PBD_ProfoundBiotinidaseDeficiency

Study ID

PBD_002

Select country

Germany

Show nearest parameters

Parameter type

Cost

Show nearest parameters

	countryLabel	distance	distanceUnit	studyIdentifier	parameterType	parameterName
0	Spain	1,913.8288	km	PBD_001	Cost	PBD_SkinProblemsManifestationCost
1	Spain	1,913.8288	km	PBD_001	Cost	PBD_HearingProblemsManifestationCost
2	Spain	1,913.8288	km	PBD_001	Cost	PBD_ScreeningCost
3	Spain	1,913.8288	km	PBD_001	Cost	PBD_MentalDelayManifestationCost
4	Spain	1,913.8288	km	PBD_001	Cost	PBD_HypotoniaManifestationCost
5	Spain	1,913.8288	km	PBD_001	Cost	PBD_VisionLossManifestationCost
6	Spain	1,913.8288	km	PBD_001	Cost	PBD_BiotinTreatmentCost
7	Spain	1,913.8288	km	PBD_001	Cost	PBD_ClinicalDiagnosisCost
8	Spain	1,913.8288	km	PBD_001	Cost	PBD_FollowUpCost
9	Spain	1,913.8288	km	PBD_001	Cost	PBD_SeizureManifestationCost



Why only rare diseases?



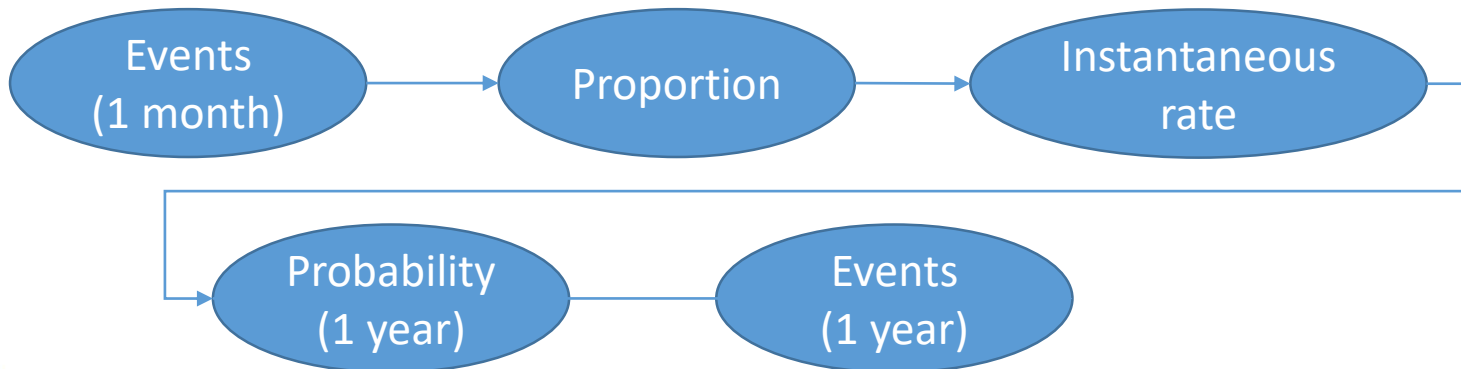
OSDi



New features



Automated transformation of parameters



New features



Automated transformation of parameters

Average cost
and SD



Gamma
parameters

New features



Automated
extraction of
parameters from
text

Infer the best
modelling
approach

Identify missing
key parameters

...

And how does it fit with
generative AIs?



Thank you for your attention...

... and join the future of HTA!

