CARRE

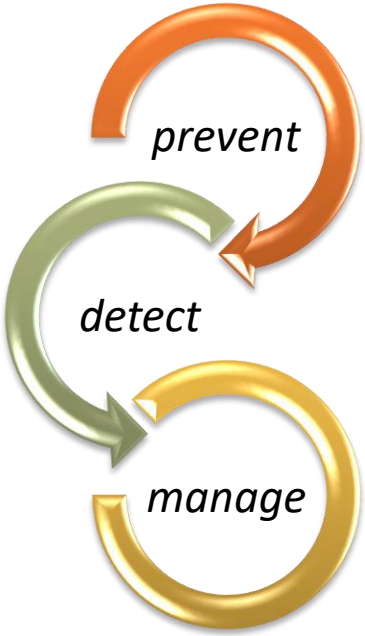
Personalized patient empowerment and shared decision support for cardiorenal disease and comorbidities

FP7-ICT-61440 Project Presentation

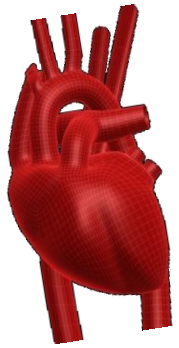
eHealth Forum 2016, Athens, Greece, 25-26 October 2016

motivation

- significant increase in the prevalence and incidence of chronic disease
- ½ of all chronic patients present comorbidities
- the chronic patient is mostly an outpatient
  - needs to care for herself at home
  - mainly away from continuous professional care
  - while trying to lead a normal life



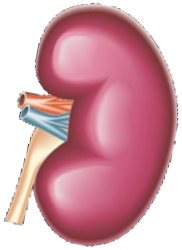
medical domain



chronic cardiorenal disease and comorbidities

- simultaneous (causal) dysfunction of kidney and heart
- diabetes and/or hypertension common underlying causes
- a number of other serious comorbidities often present

  nephrogenic anemia, renal osteodystrophy, malnutrition, blindness, neuropathy, severe atherosclerosis, cardiovascular episodes, and eventually end-stage renal disease and/or heart failure, and death



- deterioration to end stage renal/heart disease is life threatening, irreversible and expensive to manage

cardiorenal disease & comorbidities

some numbers…

- hypertension ⇨ 1/3 of adults (US 2008)
- diabetes ⇨ 8% of overall population
- chronic kidney disease ⇨ 9-16% of overall population
- 44% of chronic kidney disease is due to diabetes
- 86% of chronic kidney disease has at least 1 comorbidity
- most patients with chronic kidney disease develop cardiovascular disease

⇨ chronic heart failure ⇨ 1-2% of total healthcare costs

⇨ end-stage renal disease (dialysis) ⇨ >2% of total healthcare costs

CARRE

Cardiorenal comorbidity management via **empowerment** and shared informed decision

FP7-ICT-2013-611140

consortium: 6 partners from 4 EU countries

coordinator: Eleni Kaldoudi (DUTH)

duration: Nov 2013 – Oct 2016

budget: 3,210,470€

http://carre-project.eu/

Democritus Univ. of Thrace
DUTH, GR

The Open University, UK

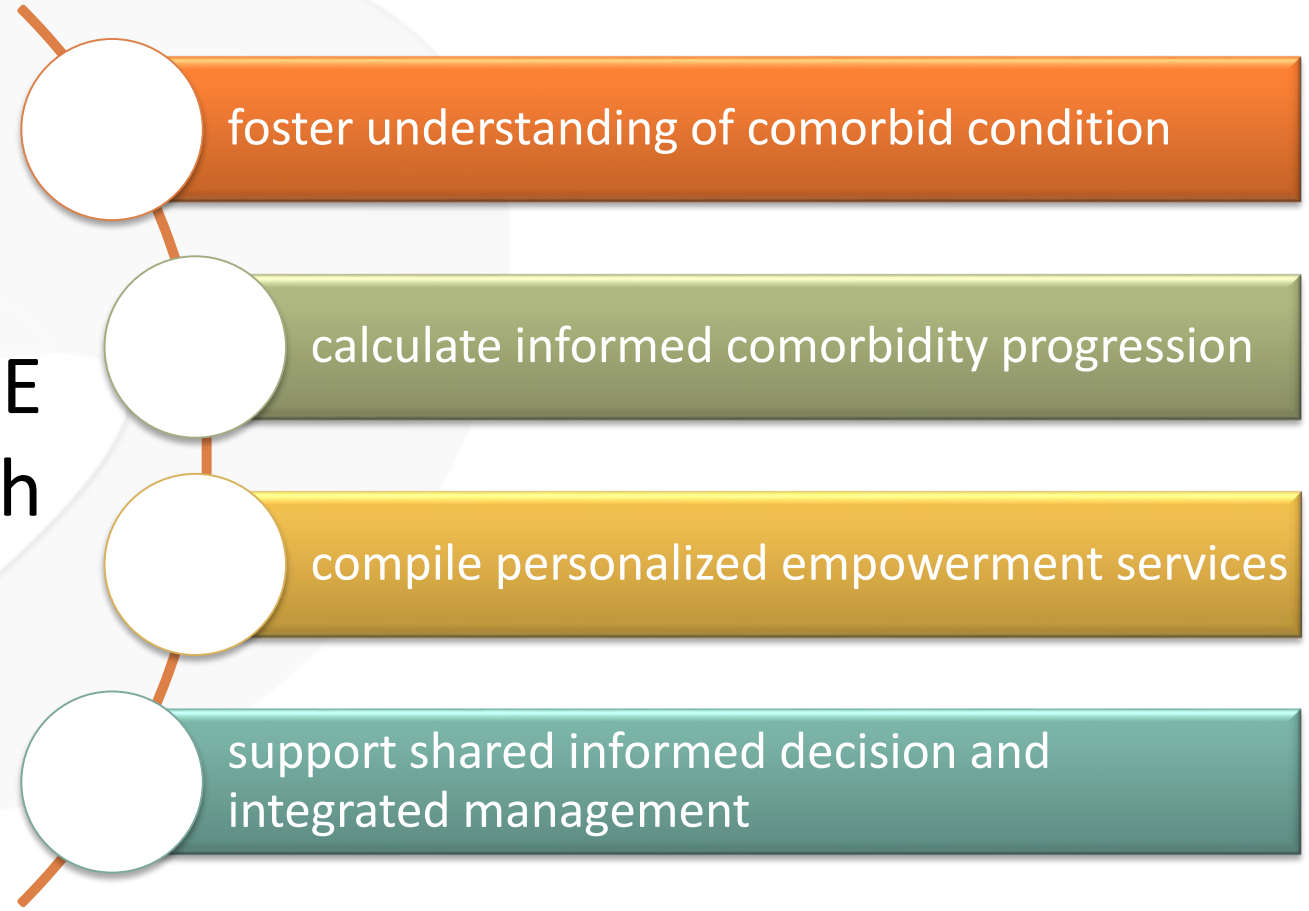
Univ. of Bedfordshire, UK

Vilnius Univ. Hospital, LT

Kaunas Univ., LT

Industrial Research Institute for Automation & Measurements, PL

CARRE approach



what?

CARRE

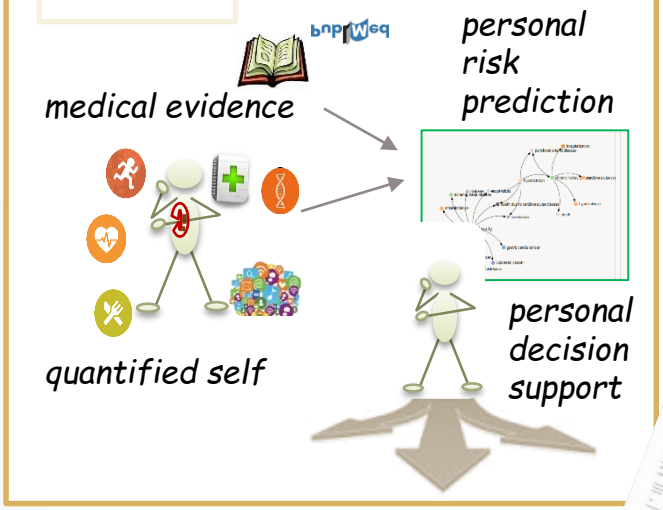
EU FP7-ICT-2013-611140
3.2M, 2013-2016
DUTH, OU, BED, VULSK, KTU, PIAP

why?

cardiorenal disease

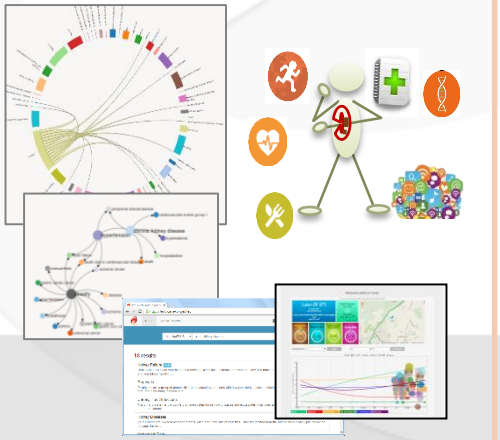
chronic, common, dangerous, expensive, with many causing factors and complex progression

how?



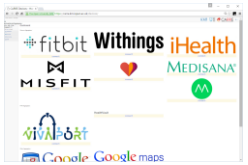
http://carre-project.eu

for the patient

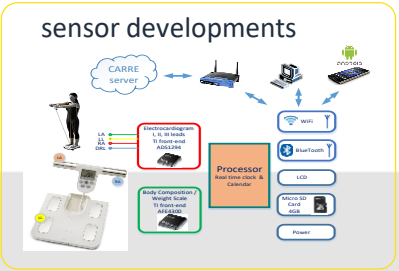


for the medical expert

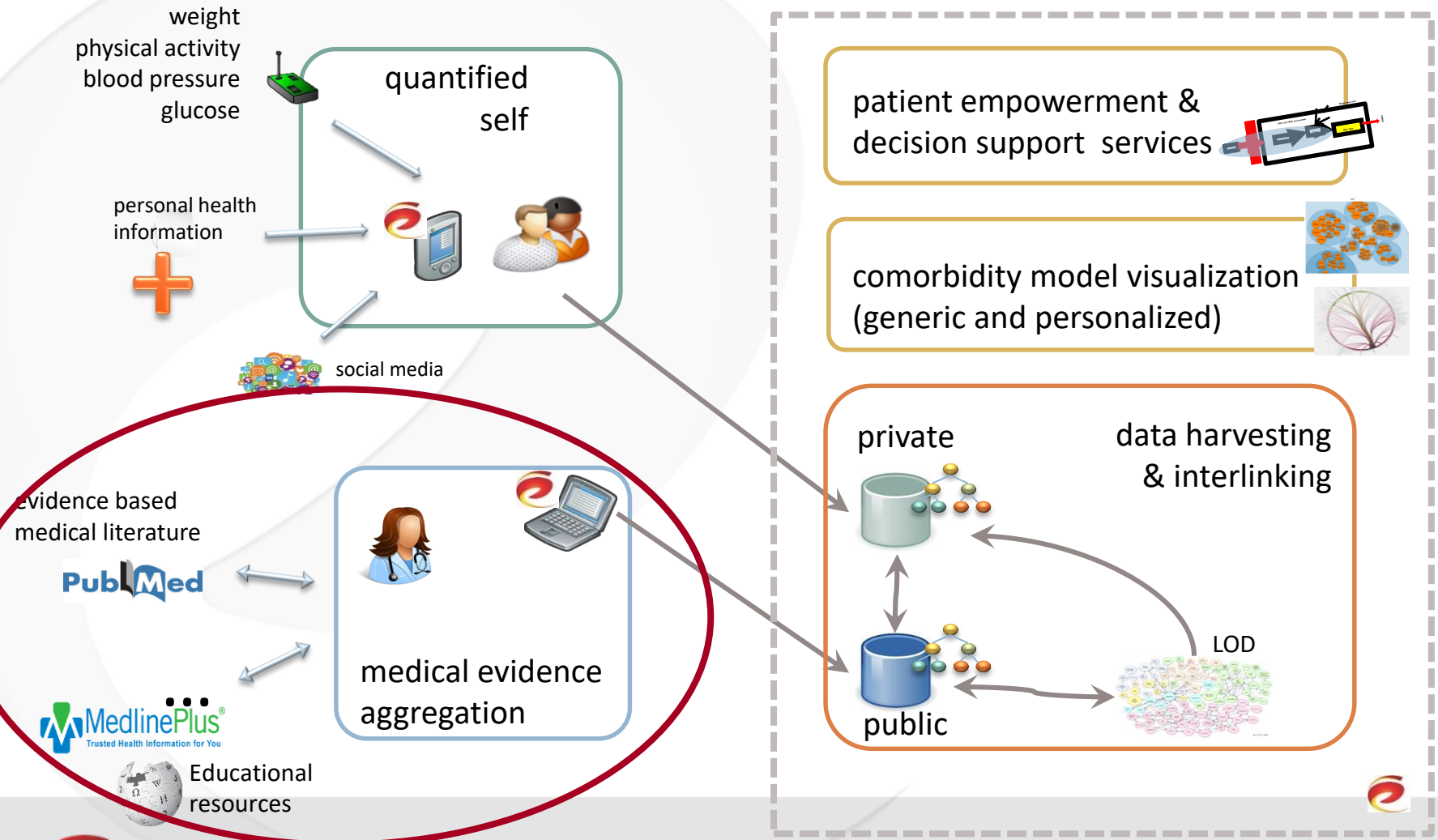
for the ICT expert



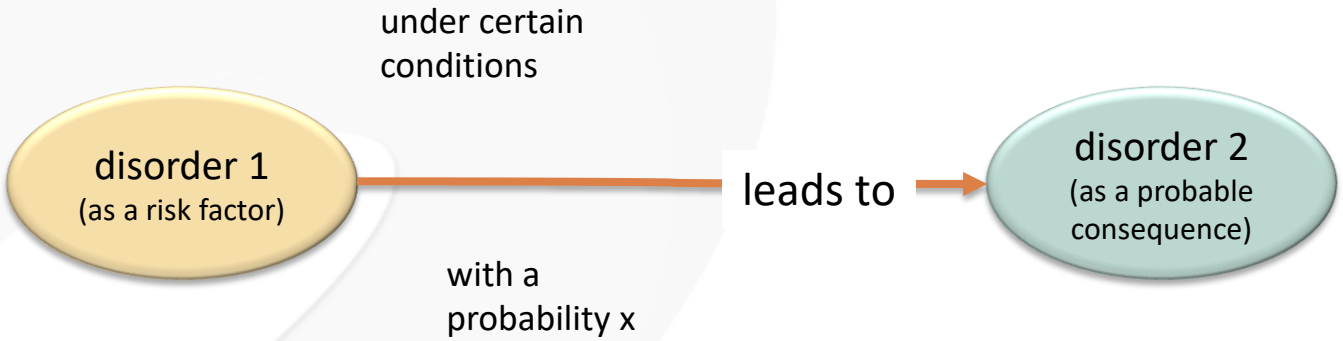
sensor developments



CARRE approach



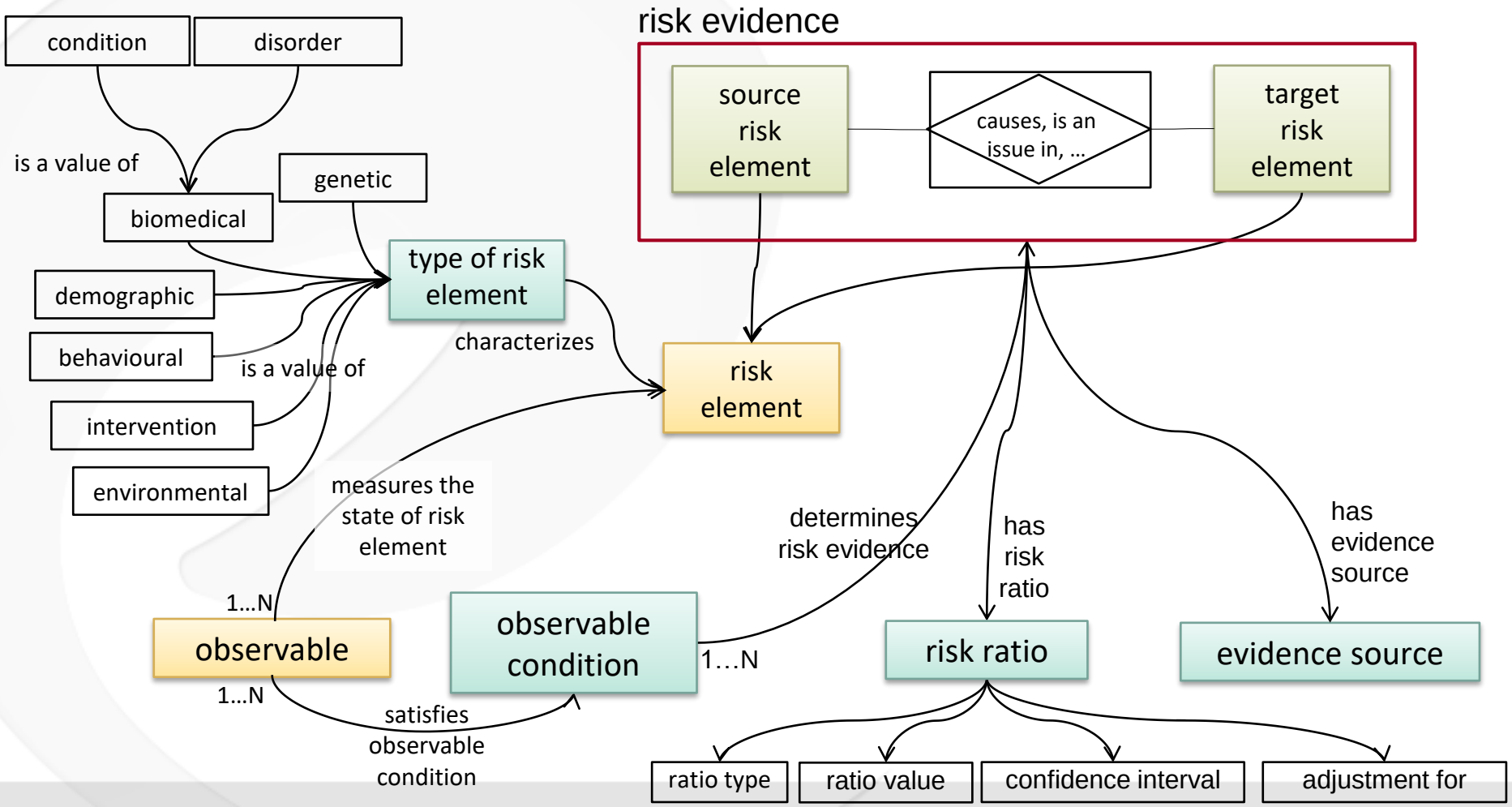
modelling health risk factors



risk factors are reported in medical literature
(top level evidence: systematic reviews with meta-analysis)

E. Kaldoudi, et al. CARRE D.2.1, 2014

modelling health risk factors



http://bioportal.bioontology.org/ontologies/CARRE

BioPortal Browse Search Mappings Recommender Annotator Resource Index Projects Sign In Help Feedback

CARRE Risk Factor ontology

Summary Classes Properties Notes Mappings Widgets

Details

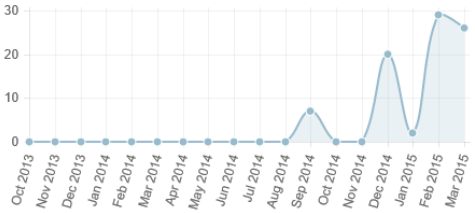
ACRONYM	CARRE
VISIBILITY	Public
BIOPORTAL PURL	http://purl.bioontology.org/ontology/CARRE
DESCRIPTION	Clinical risk factors, evidence and observables
STATUS	Beta
FORMAT	OWL
CONTACT	Allan Third, allan.third@open.ac.uk
HOME PAGE	http://www.carre-project.eu
PUBLICATIONS PAGE	
DOCUMENTATION PAGE	
CATEGORIES	Health
GROUPS	

Metrics

We have not yet calculated metrics for this ontology.

Visits

Download as CSV



Reviews

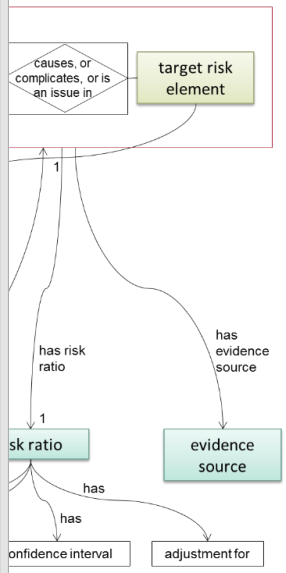
Add your review

No reviews available.

Submissions

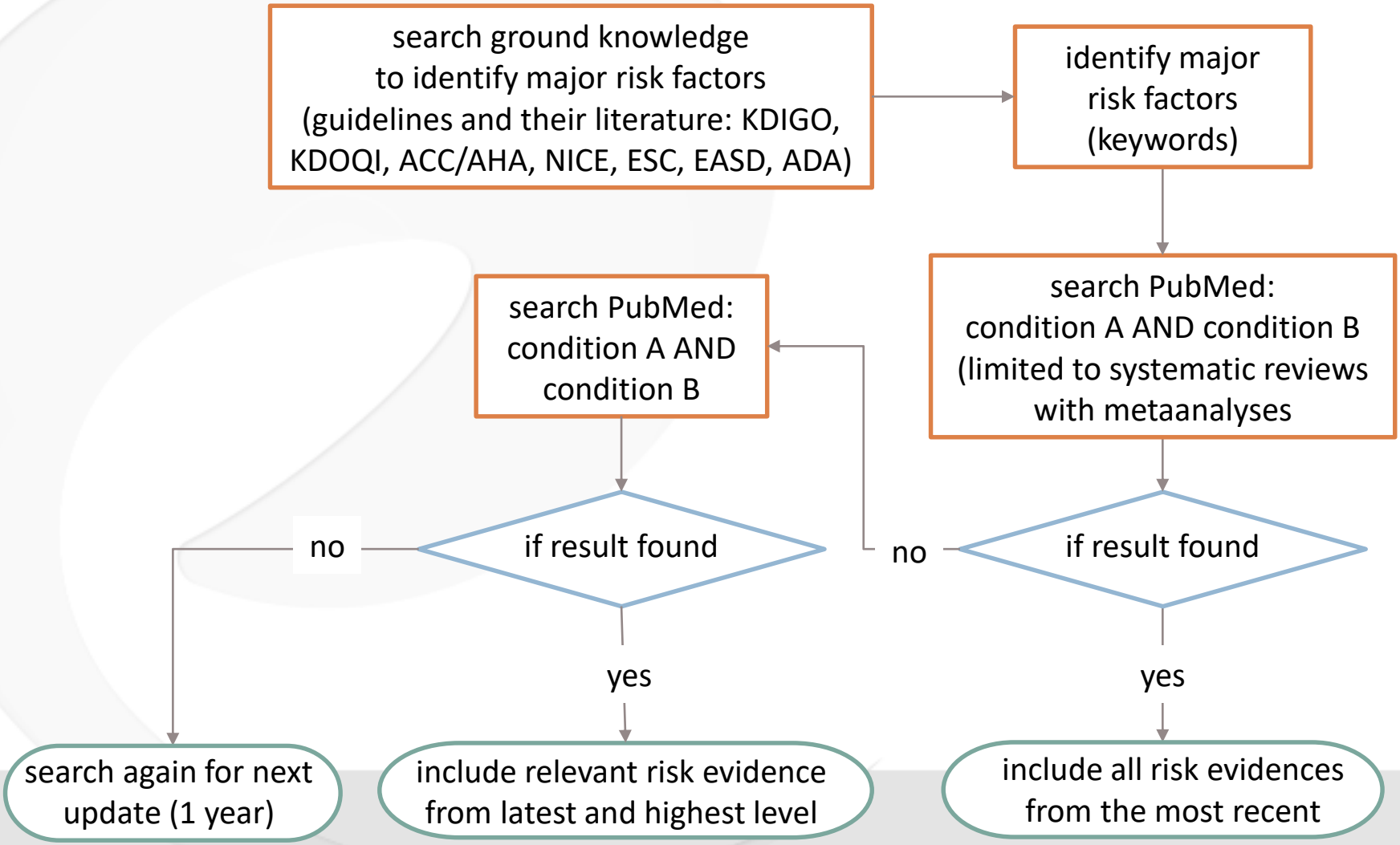
SUBMISSION	RELEASE DATE	UPLOAD DATE	DOWNLOADS
0.2 (Parsed, Indexed, Metrics, Annotator)	09/30/2014	12/08/2014	OWL | CSV | RDF/XML | Diff
0.1 (Archived)	09/30/2014	12/08/2014	OWL | Diff
0.1 (Archived)	09/30/2014	09/30/2014	OWL

ceptual model



CARRE ontology published in NCBO BioPortal
http://bioportal.bioontology.org/ontologies/CARRE

risk factor identification methodology



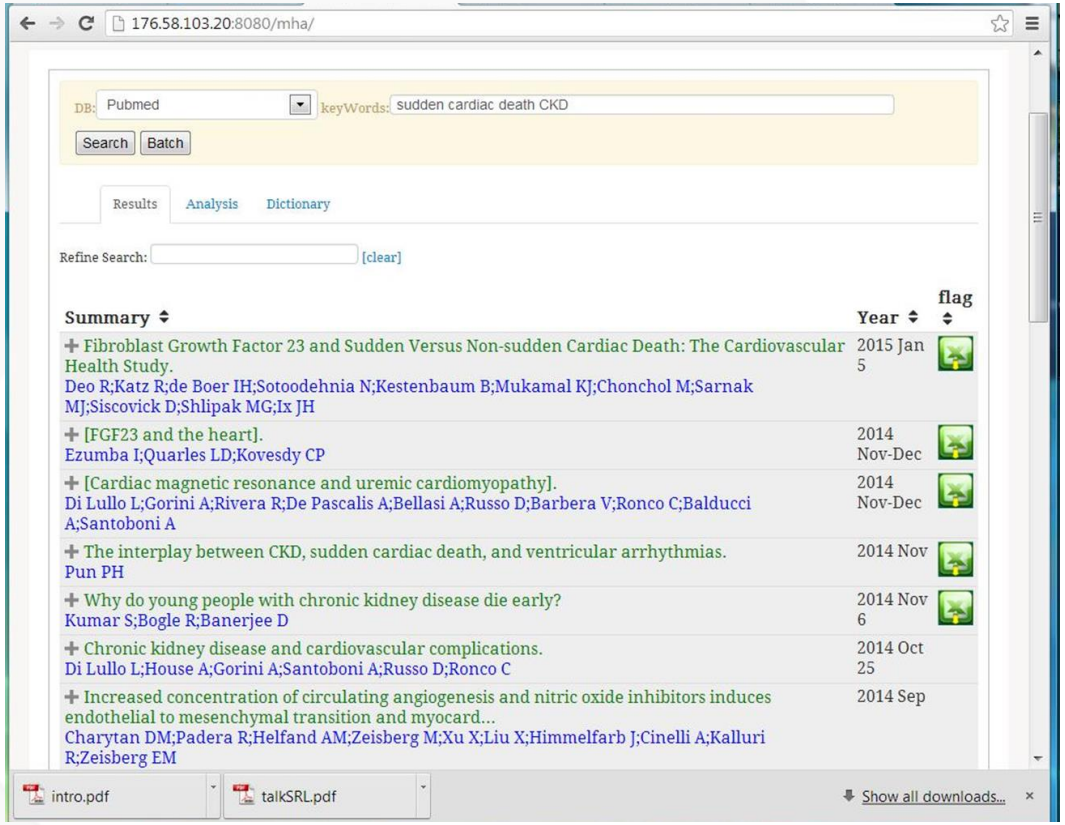
E. Kaldoudi, et al. CARRE D.2.2, 2014

some of the major related conditions

1. *Acute kidney injury*
2. *Acute myocardial infarction*
3. *Age*
4. *Albuminuria*
5. *Anaemia*
6. *Angina pectoris*
7. *Asthma*
8. *Atrial fibrillation*
9. *Chronic kidney disease*
10. *Chronic obstructive pulmonary disease*
11. *Cholelithiasis*
12. *Colorectal Cancer*
13. *Coronary and carotid revascularisation*
14. *Death*
15. *Depression*
16. *Diabetes*
17. *Diabetic nephropathy*
18. *Drugs*
19. *Dyslipidemia*
20. *Family history*
21. *Heart Failure*
22. *Hyperkalemia*
23. *Hypertension*
24. *Hyperuricemia*
25. *Hypoglycaemia*
26. *Ischemic heart disease*
27. *Ischemic stroke*
28. *Left ventricular hypertrophy*
29. *Obesity*
30. *Obstructive Sleep Apnoea*
31. *Myocardial infarction*
32. *Osteoarthritis*
33. *Pancreatic Cancer*
34. *Peripheral Arterial Disease*
35. *Physical activity*
36. *Smoking*
37. *…*

medical evidence aggregator

https://www.carre-project.eu/innovation/medical-evidence-aggregator/



sentence splitter

↓

tokenizer (GATE &Jape)

↓

part-of-speech tagging

↓

dependency parsing

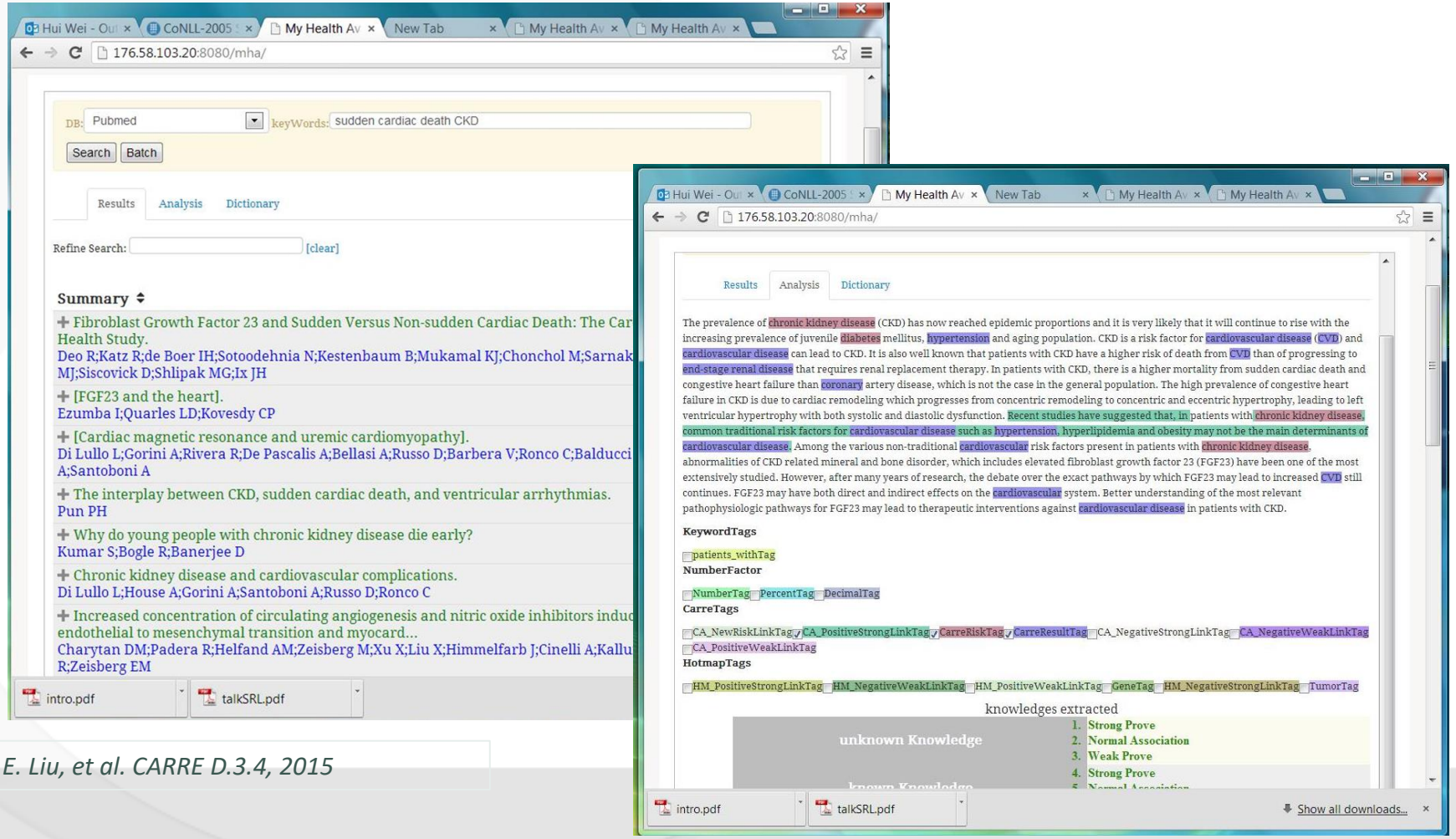
↓

semantic role labelling

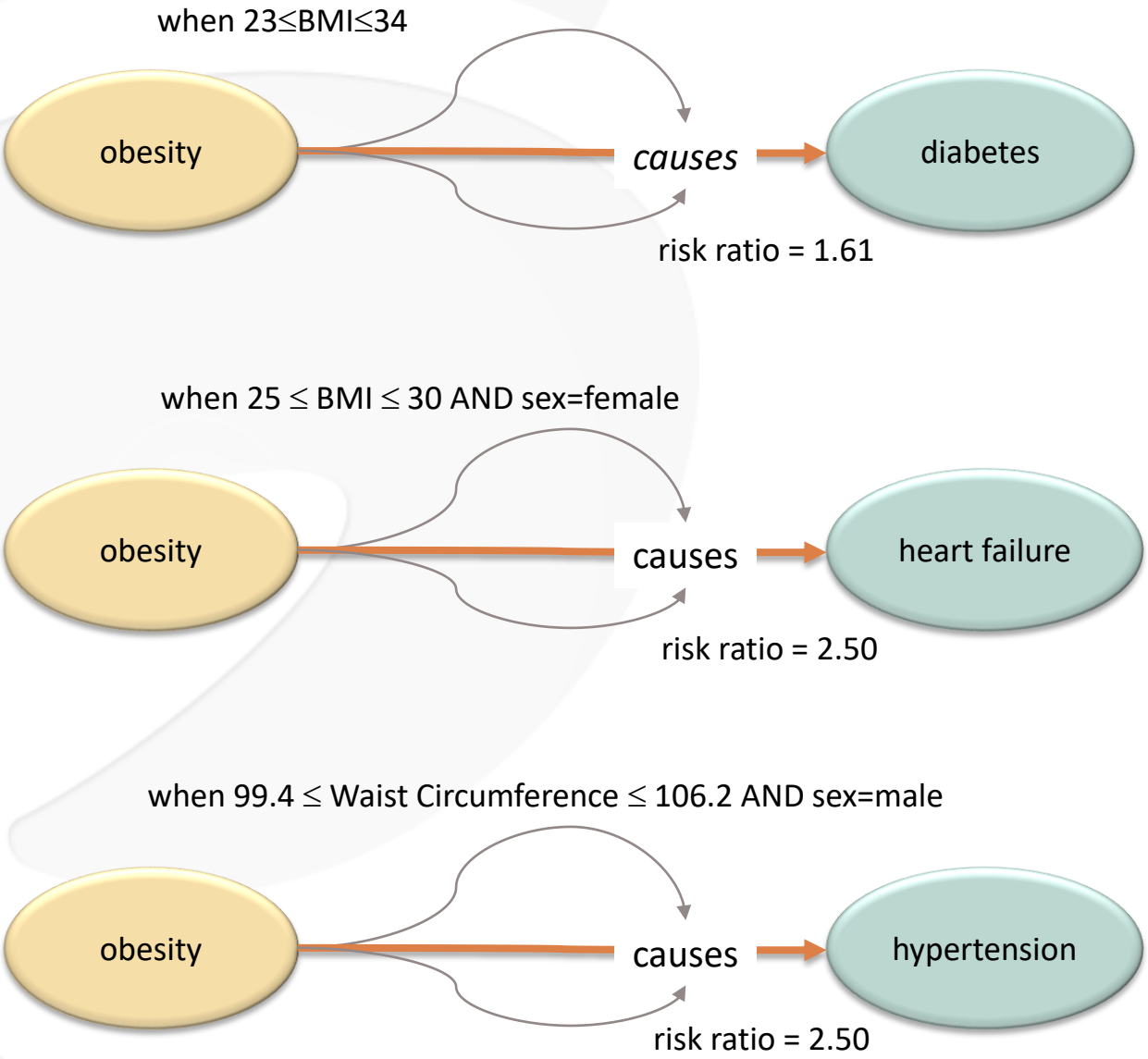
E. Liu, et al. CARRE D.3.4, 2015

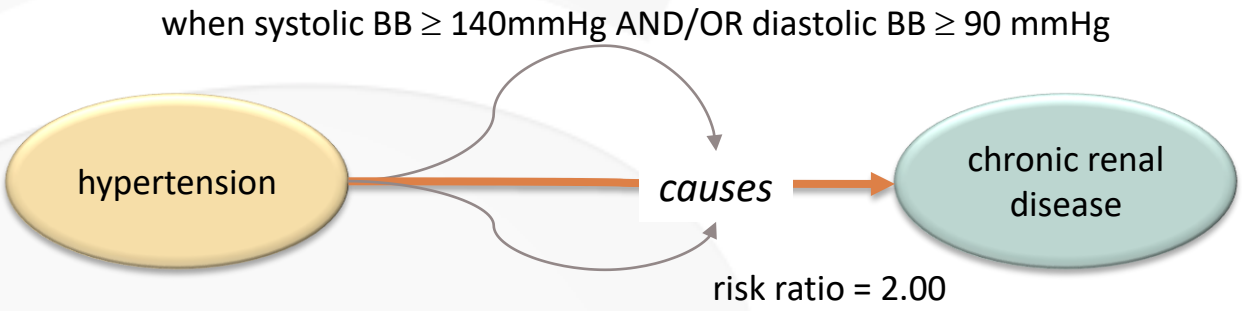
medical evidence aggregator

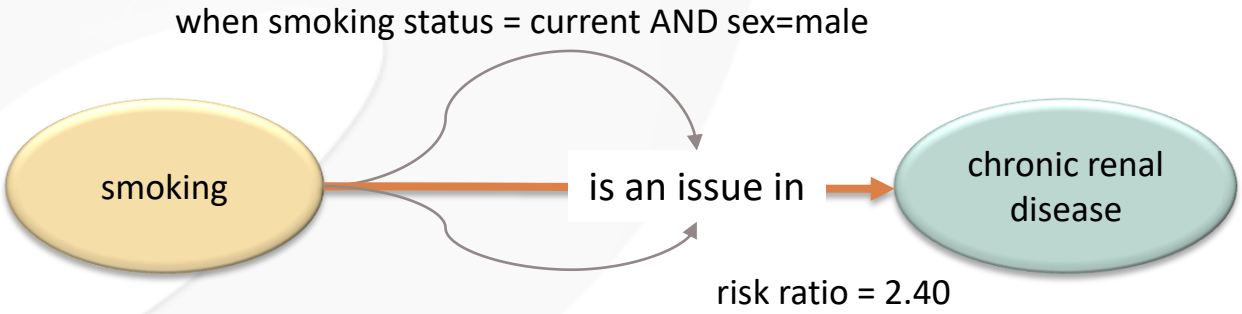
https://www.carre-project.eu/innovation/medical-evidence-aggregator/



E. Liu, et al. CARRE D.3.4, 2015


when 23≤BMI≤34
obesity
causes
diabetes
risk ratio = 1.61
when 25 ≤ BMI ≤ 30 AND sex=female
obesity
causes
heart failure
risk ratio = 2.50
when 99.4 ≤ Waist Circumference ≤ 106.2 AND sex=male
obesity
causes
hypertension
risk ratio = 2.50



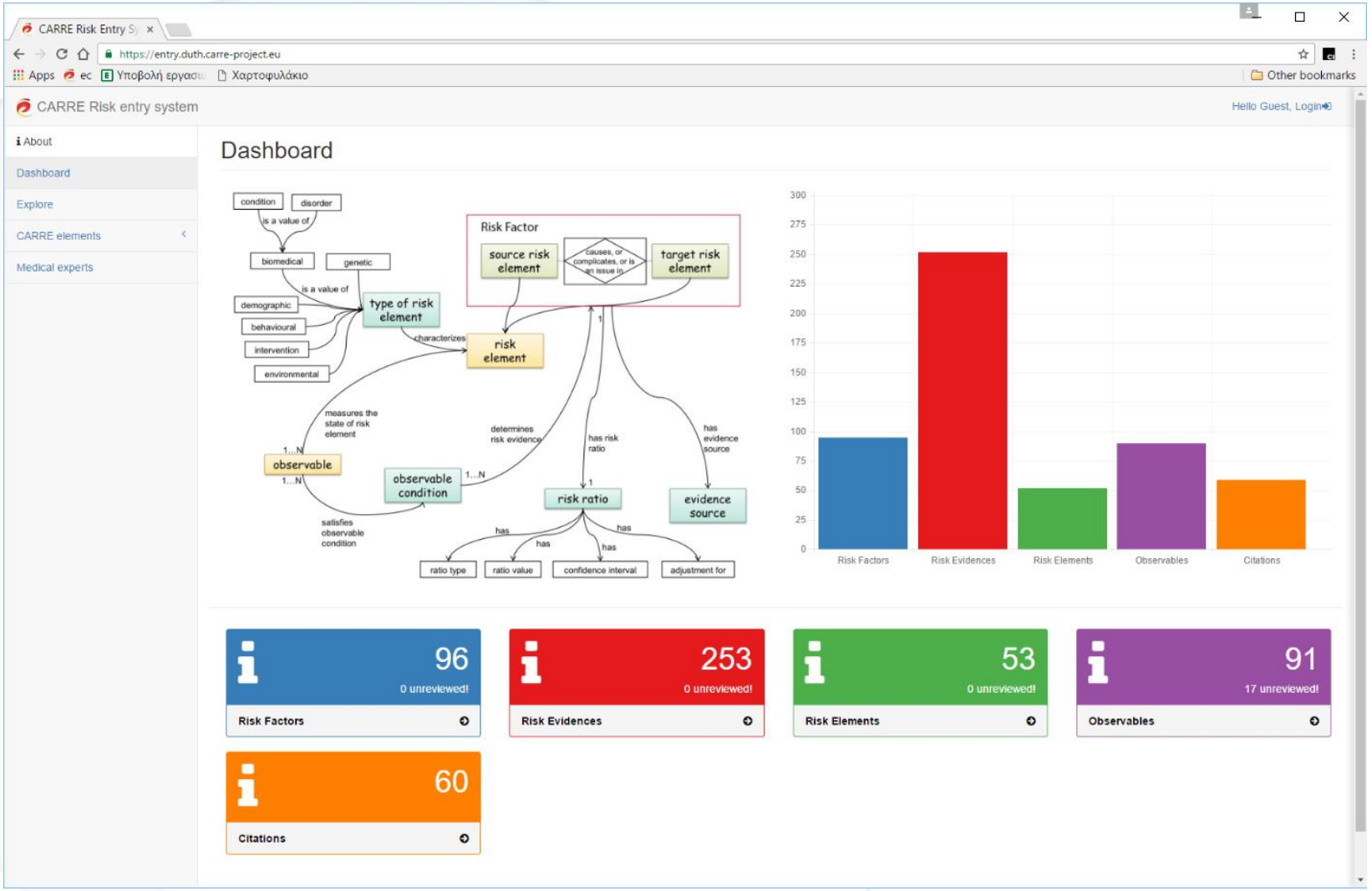


so far… 253 major risk associations (or evidences) identified in medical literature

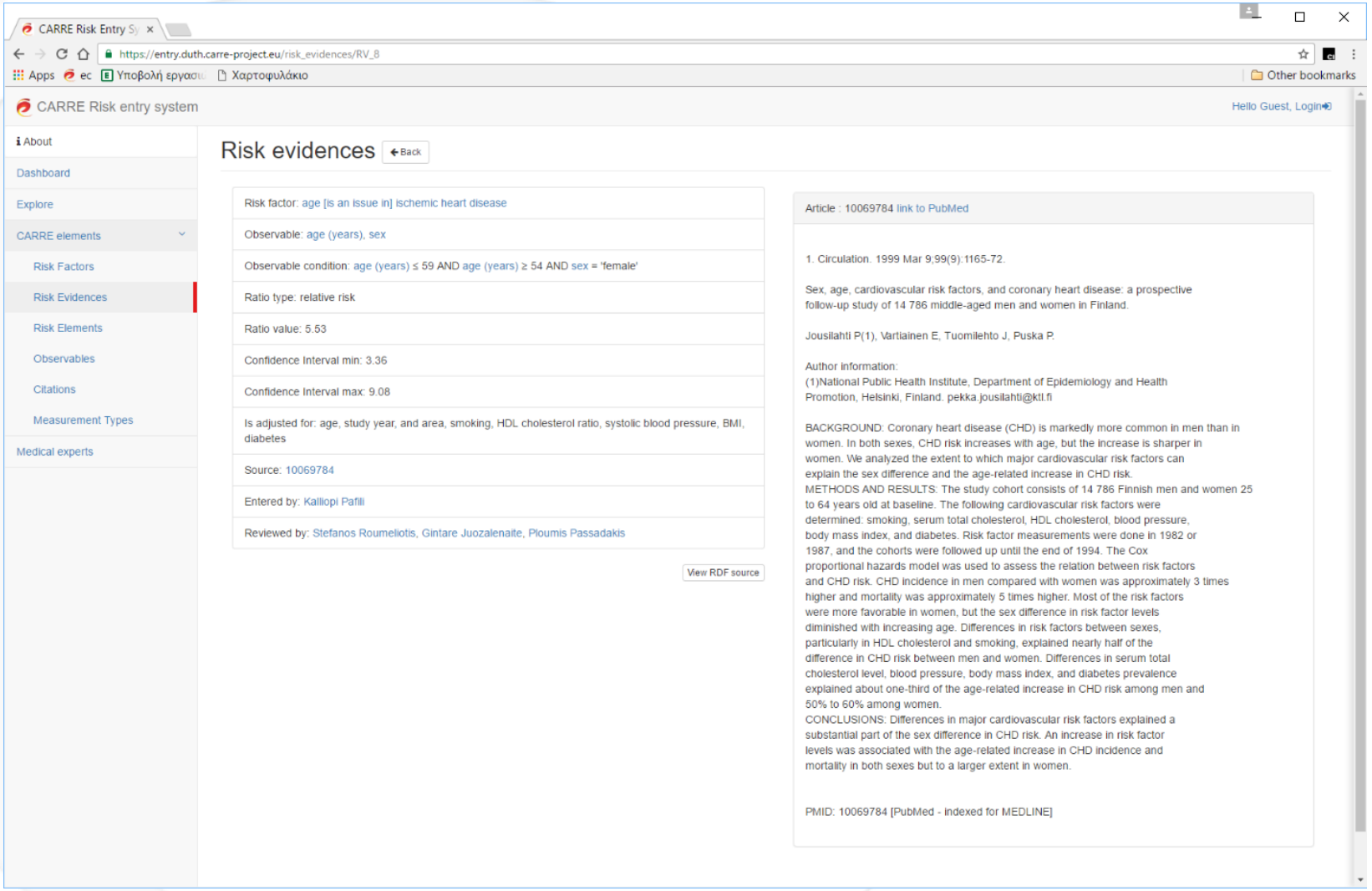
(which involve 53 health conditions and 82 related observables)

as included in the CARRE risk factor database and predictive model

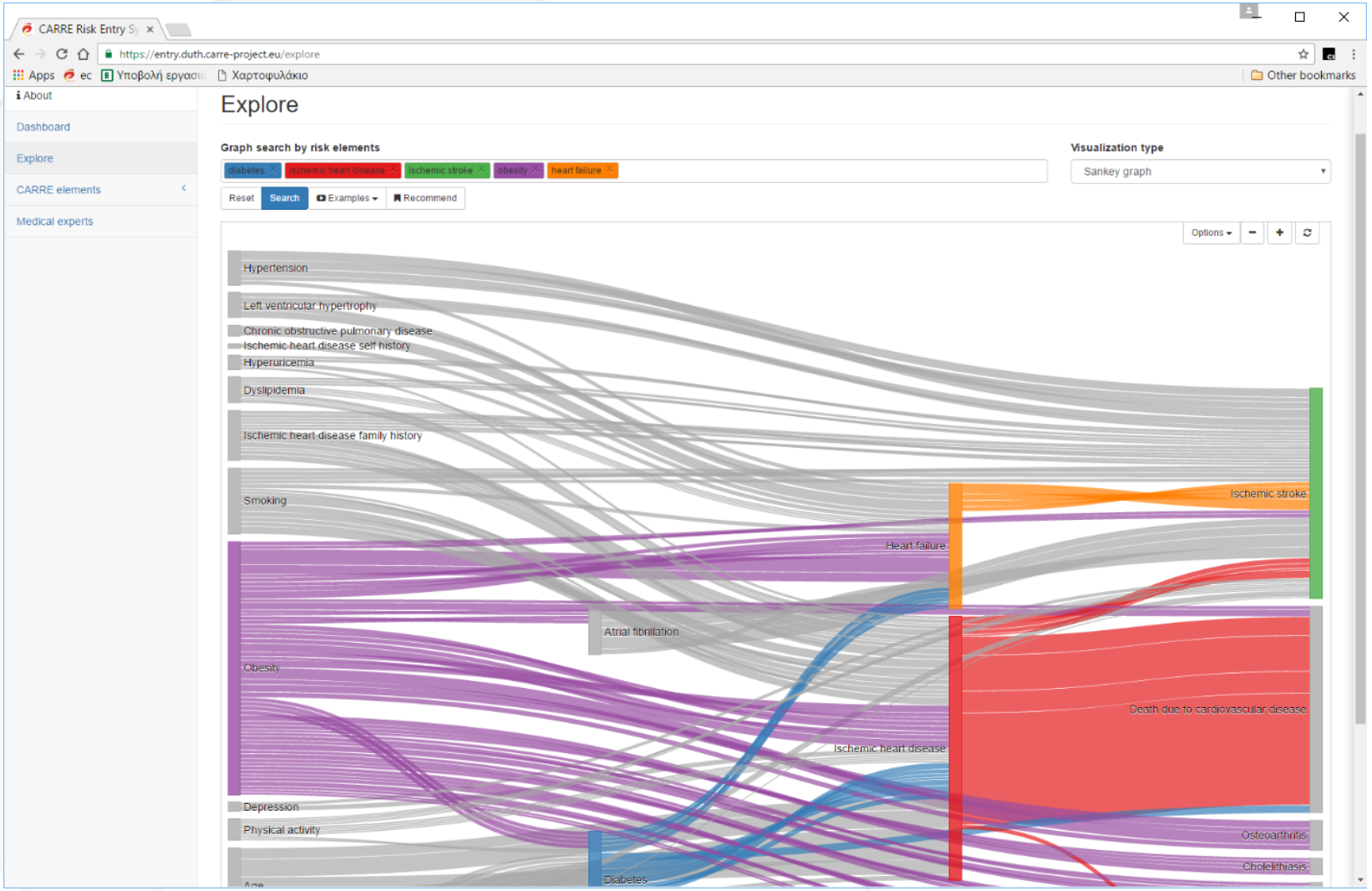
risk factor reference repository



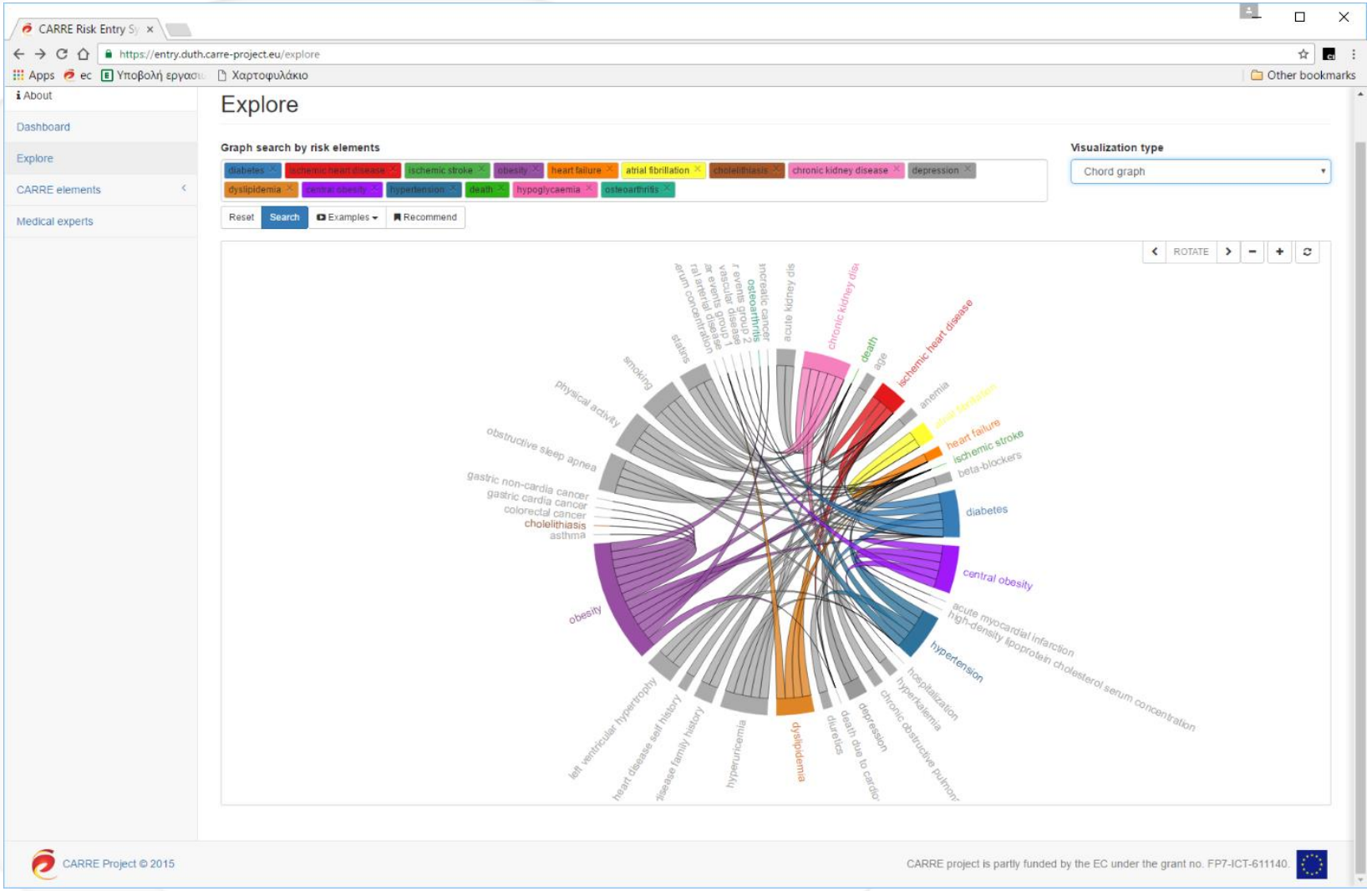
risk factor reference repository



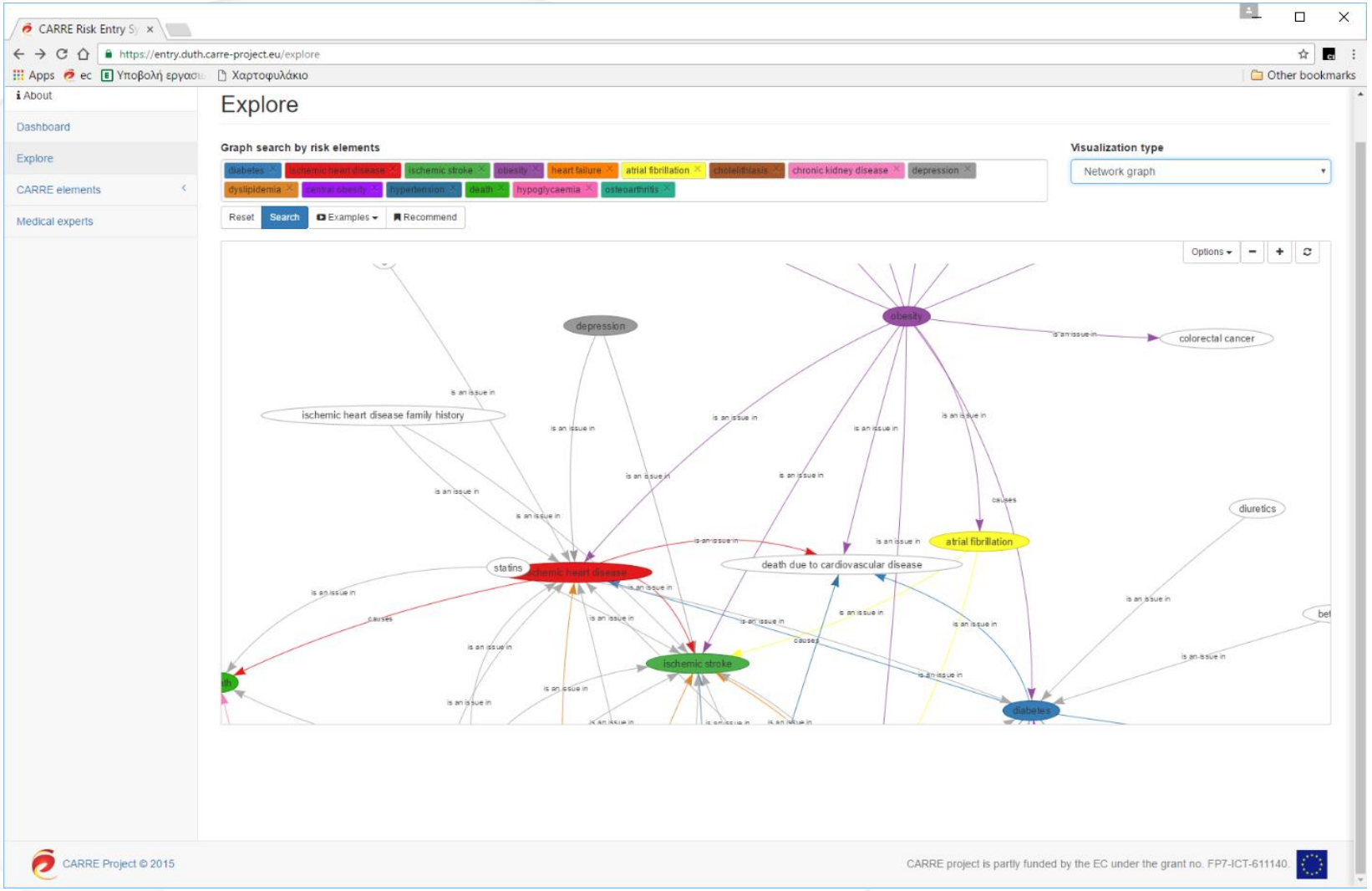
risk factor reference repository



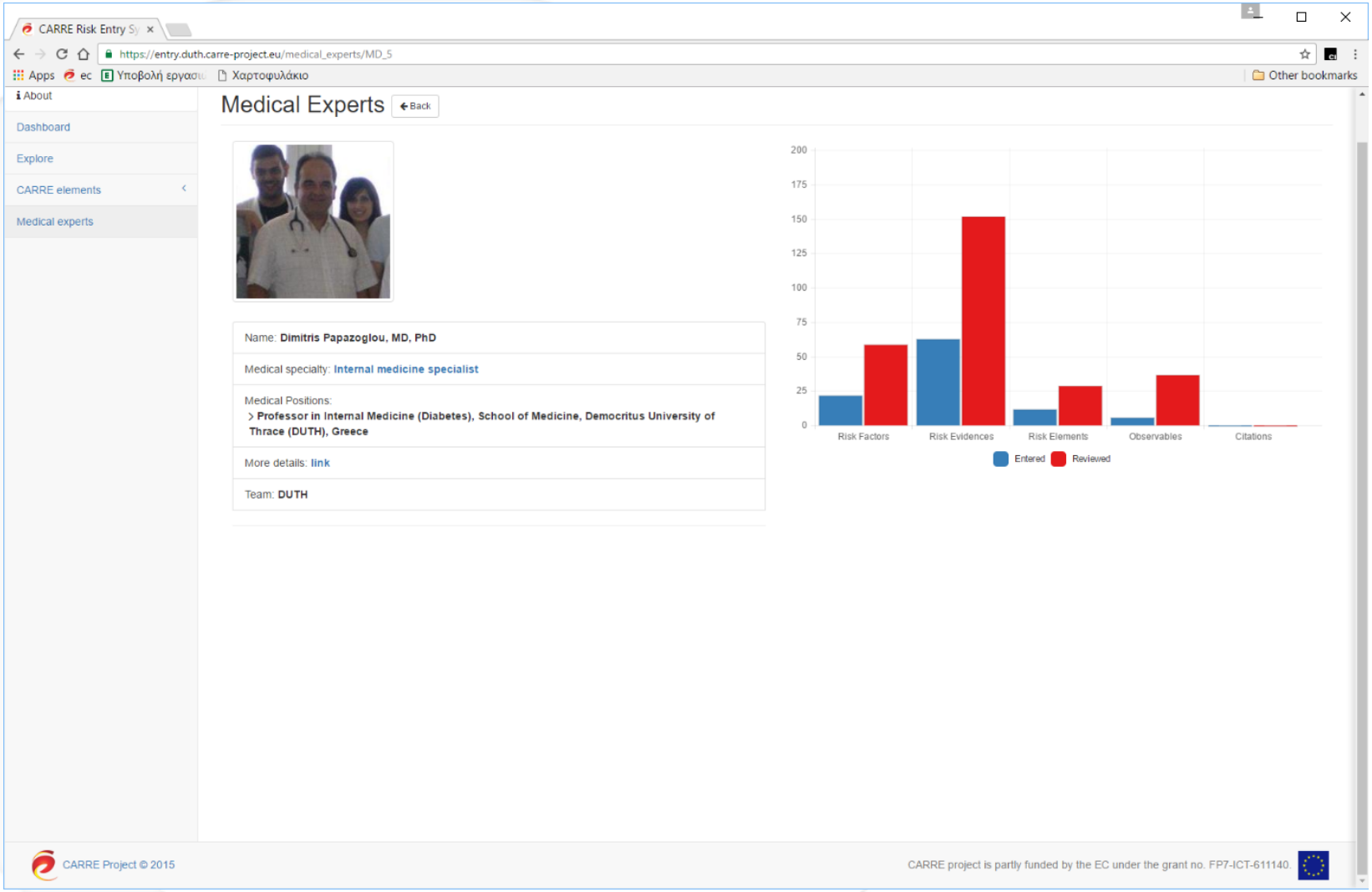
risk factor reference repository



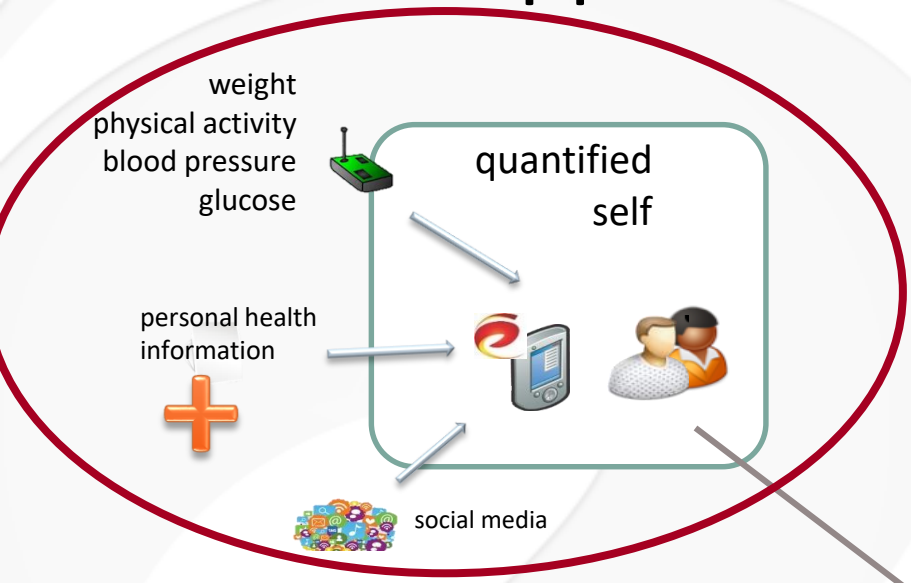
risk factor reference repository

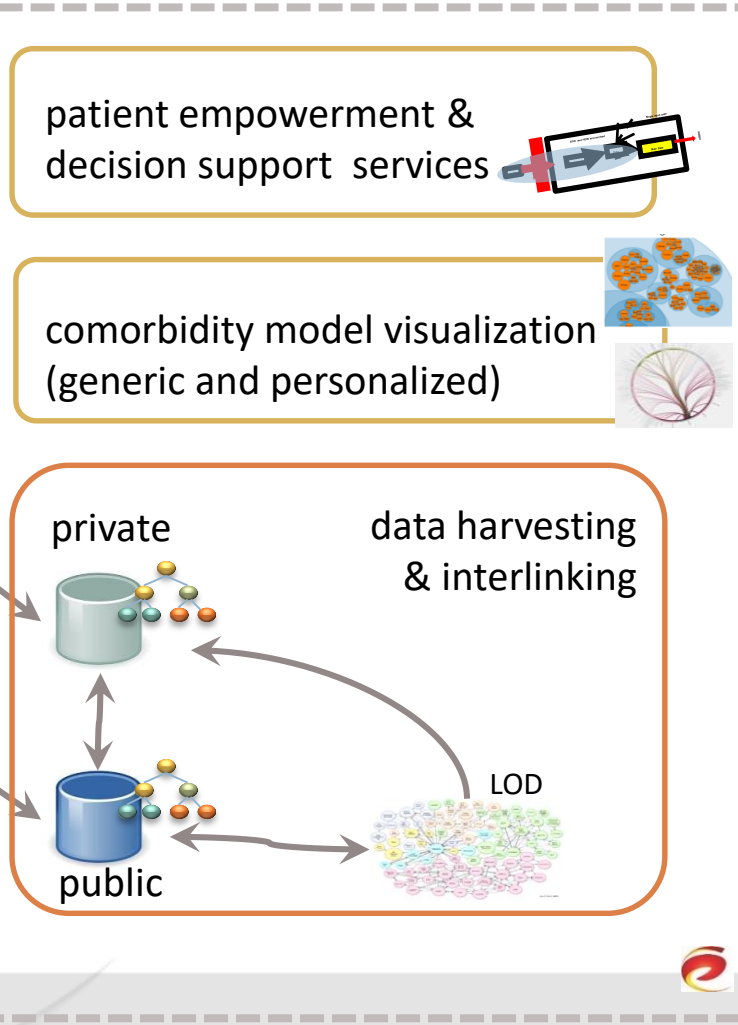


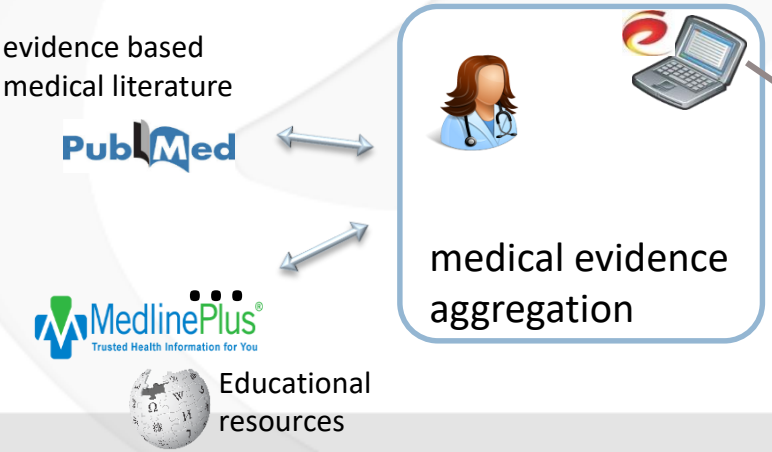
risk factor reference repository



CARRE approach





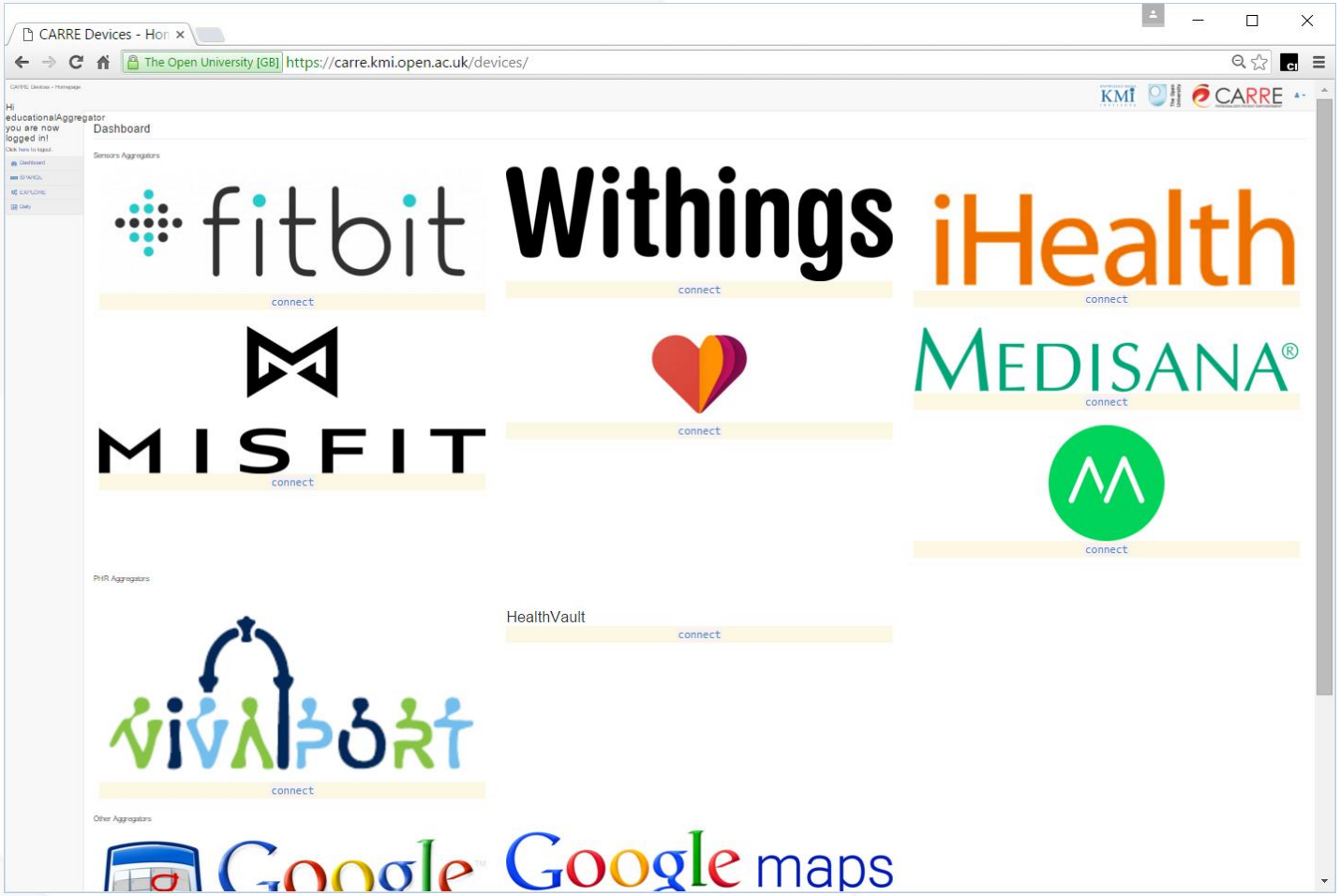


personal data aggregators

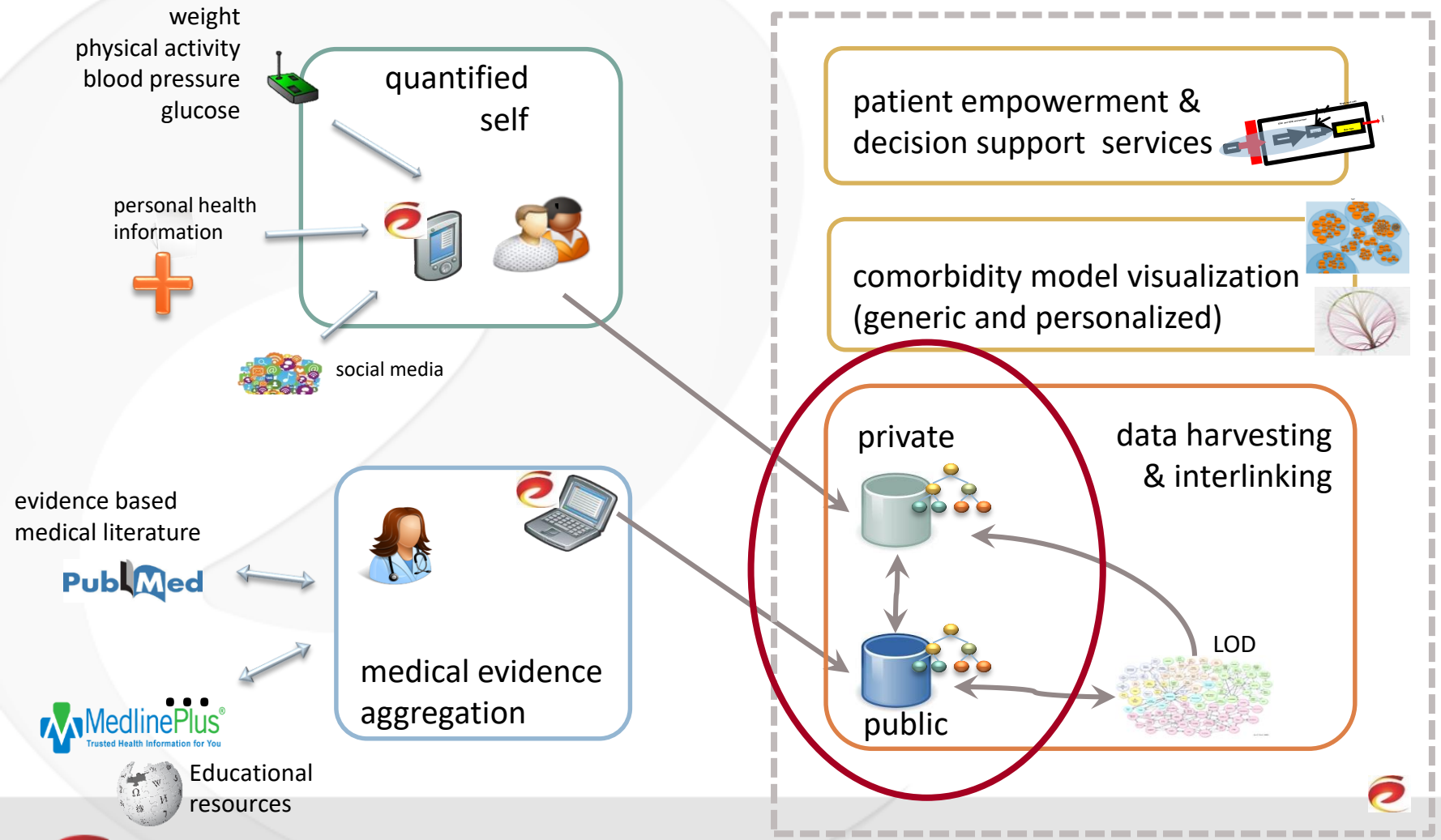
- sensor aggregators
- medical data aggregators from personal health record
- manual entry system for personal medical data
- intention extraction form web searches

CARRE D.3..2 & D.3.3, 2015

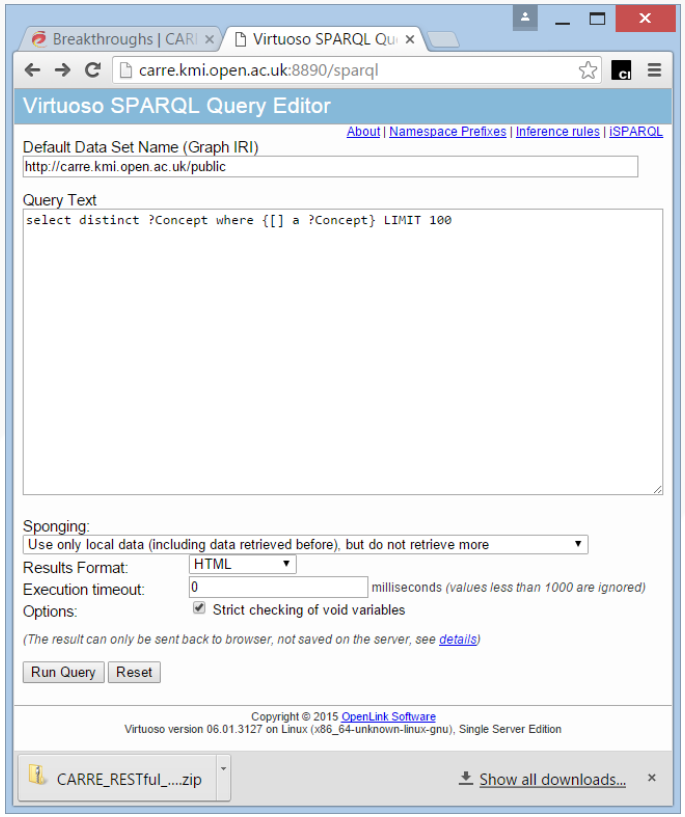
aggregator integration
https://carre.kmi.open.ac.uk/devices/

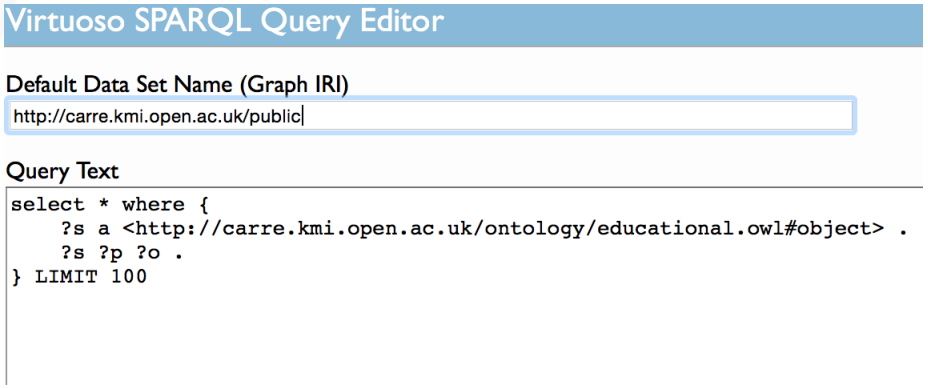


CARRE approach



public RDF SPARQL endpoint





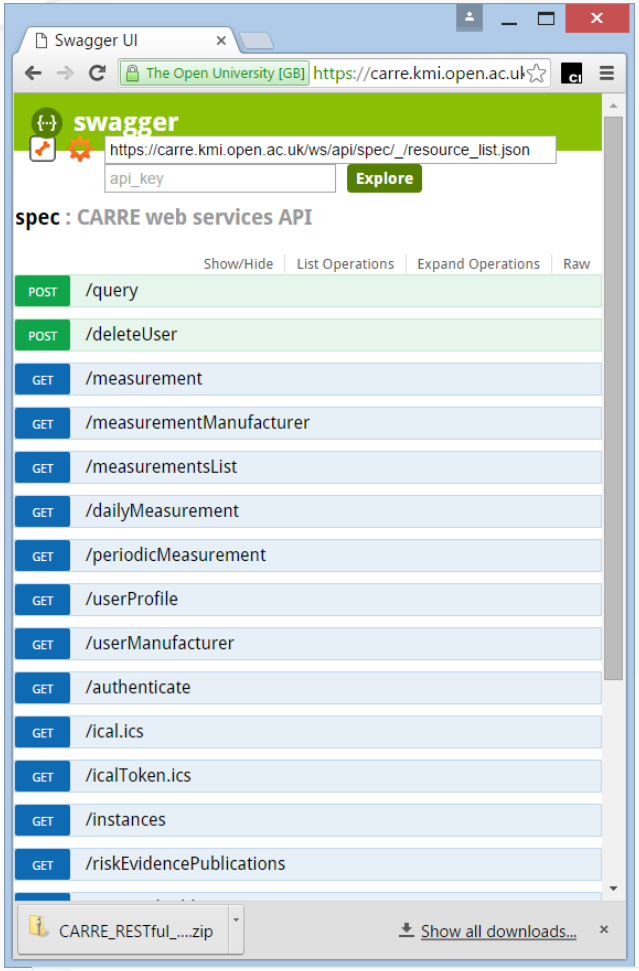
a SPARQL query to retrieve RDF triples about educational objects

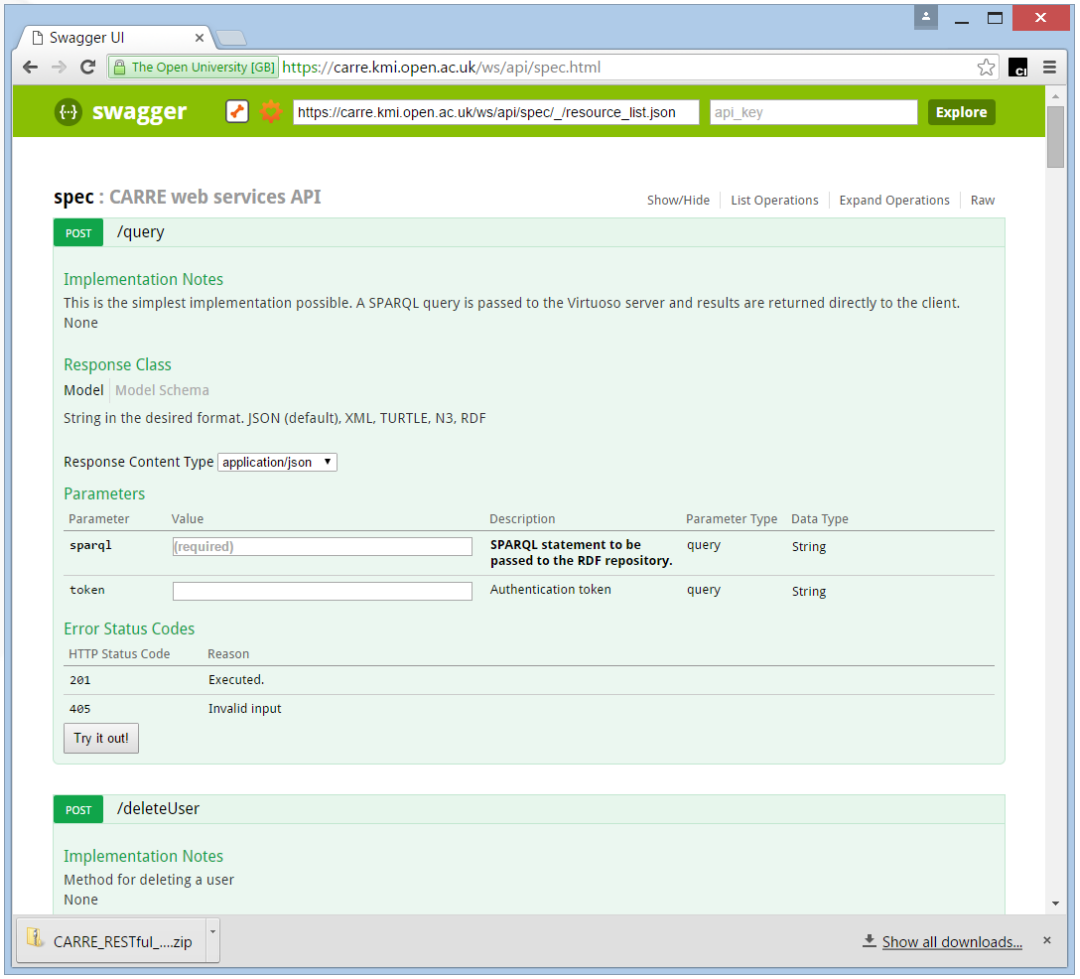
A. Third et al, CARRE D.4.1 & D.4.2, 2015

triples about educational objects

http://carre.kmi.open.ac.uk/beta/educational/dcb53878-7a19-4897-9d7c-cfc69bd16140	http://carre.kmi.open.ac.uk/ontology/educational.owl#url	http://en.wikipedia.org/wiki/Metabolic_syndrome
http://carre.kmi.open.ac.uk/beta/educational/dcb53878-7a19-4897-9d7c-cfc69bd16140	http://carre.kmi.open.ac.uk/ontology/educational.owl#title	"Metabolic syndrome"^^<http://www.w3.org/2001/XMLSchema#stri
http://carre.kmi.open.ac.uk/beta/educational/dcb53878-7a19-4897-9d7c-cfc69bd16140	http://carre.kmi.open.ac.uk/ontology/educational.owl#views	2
http://carre.kmi.open.ac.uk/beta/educational/dcb53878-7a19-4897-9d7c-cfc69bd16140	http://carre.kmi.open.ac.uk/ontology/educational.owl#date_accepted	2015-04-26
http://carre.kmi.open.ac.uk/beta/educational/dcb53878-7a19-4897-9d7c-cfc69bd16140	http://carre.kmi.open.ac.uk/ontology/educational.owl#snippet	"tissue, ultimately promoting visceral adiposity, insulin resistance, dy effects on the bone, causing "low turnover""^^<http://ww
http://carre.kmi.open.ac.uk/beta/educational/dcb53878-7a19-4897-9d7c-cfc69bd16140	http://carre.kmi.open.ac.uk/ontology/educational.owl#language	"English"^^<http://www.w3.org/2001/XMLSchema#string>
http://carre.kmi.open.ac.uk/beta/educational/dcb53878-7a19-4897-9d7c-cfc69bd16140	http://carre.kmi.open.ac.uk/ontology/educational.owl#wordcount	5690
http://carre.kmi.open.ac.uk/beta/educational/dcb53878-7a19-4897-9d7c-cfc69bd16140	http://carre.kmi.open.ac.uk/ontology/educational.owl#websource	"wikipedia"^^<http://www.w3.org/2001/XMLSchema#string>
http://carre.kmi.open.ac.uk/beta/educational/bedc4c16-ad7e-4052-bf69-156dfd60e136	http://www.w3.org/1999/02/22-rdf-syntax-ns#type	http://carre.kmi.open.ac.uk/ontology/educational.owl#object
http://carre.kmi.open.ac.uk/beta/educational/bedc4c16-ad7e-4052-bf69-156dfd60e136	http://carre.kmi.open.ac.uk/ontology/educational.owl#url	http://www.nlm.nih.gov/medlineplus/angina.html
http://carre.kmi.open.ac.uk/beta/educational/bedc4c16-ad7e-4052-bf69-156dfd60e136	http://carre.kmi.open.ac.uk/ontology/educational.owl#title	"Angina"^^<http://www.w3.org/2001/XMLSchema#string>
http://carre.kmi.open.ac.uk/beta/educational/bedc4c16-ad7e-4052-bf69-156dfd60e136	http://carre.kmi.open.ac.uk/ontology/educational.owl#views	5
http://carre.kmi.open.ac.uk/beta/educational/bedc4c16-ad7e-4052-bf69-156dfd60e136	http://carre.kmi.open.ac.uk/ontology/educational.owl#date_accepted	2015-03-03
http://carre.kmi.open.ac.uk/beta/educational/bedc4c16-		"Angina is chest pain or discomfort you feel when there is not enough heart muscle needs the oxygen that the blood carries. Angina may fee chest. It may feel like indigestion. You may also feel pain in your sho a symptom of coronary artery disease (CAD), the most common heart substance called plaque builds up in the arteries that supply blood to t three types of angina:Stable angina is the most common type. It happe

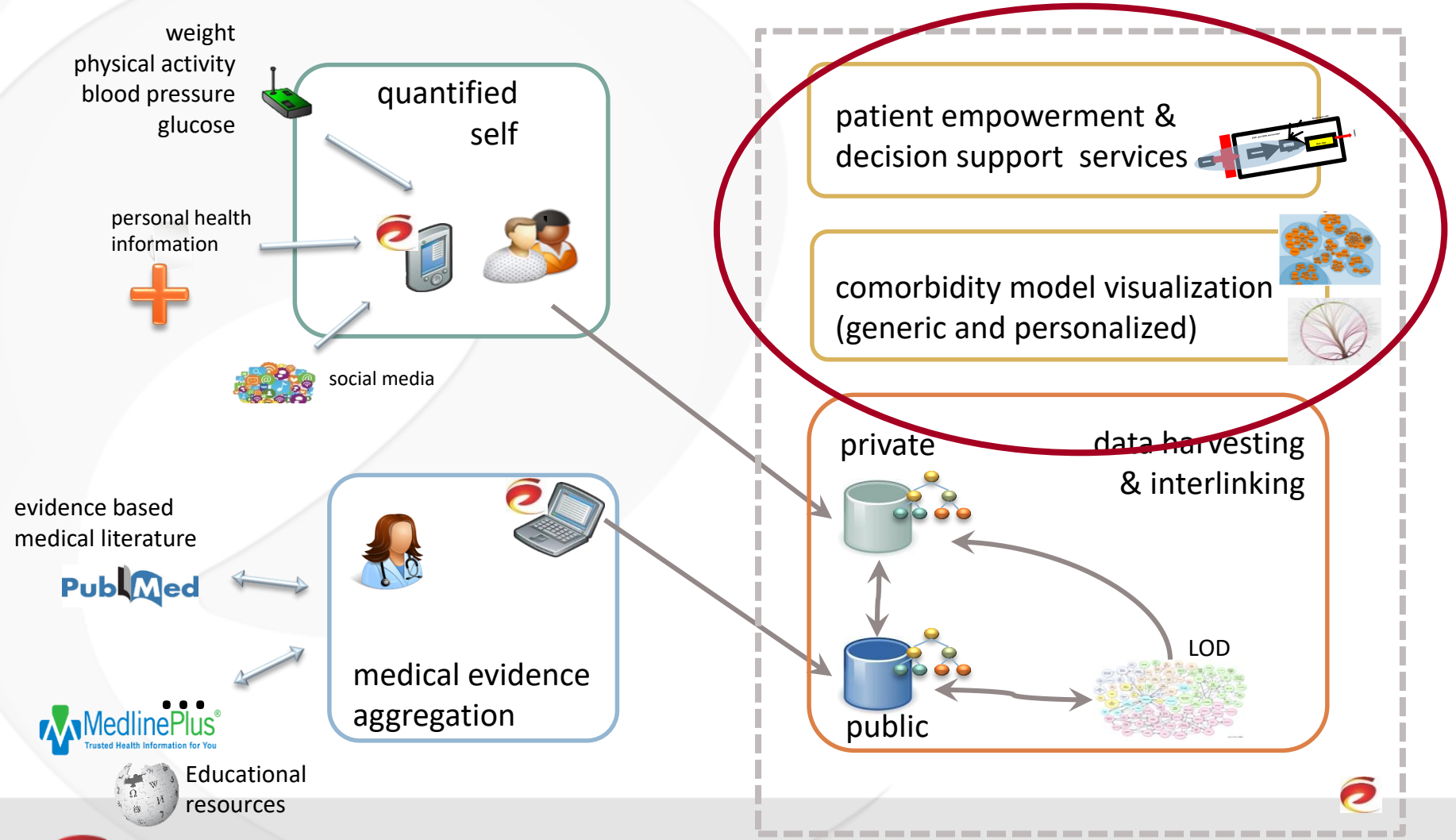
restful API



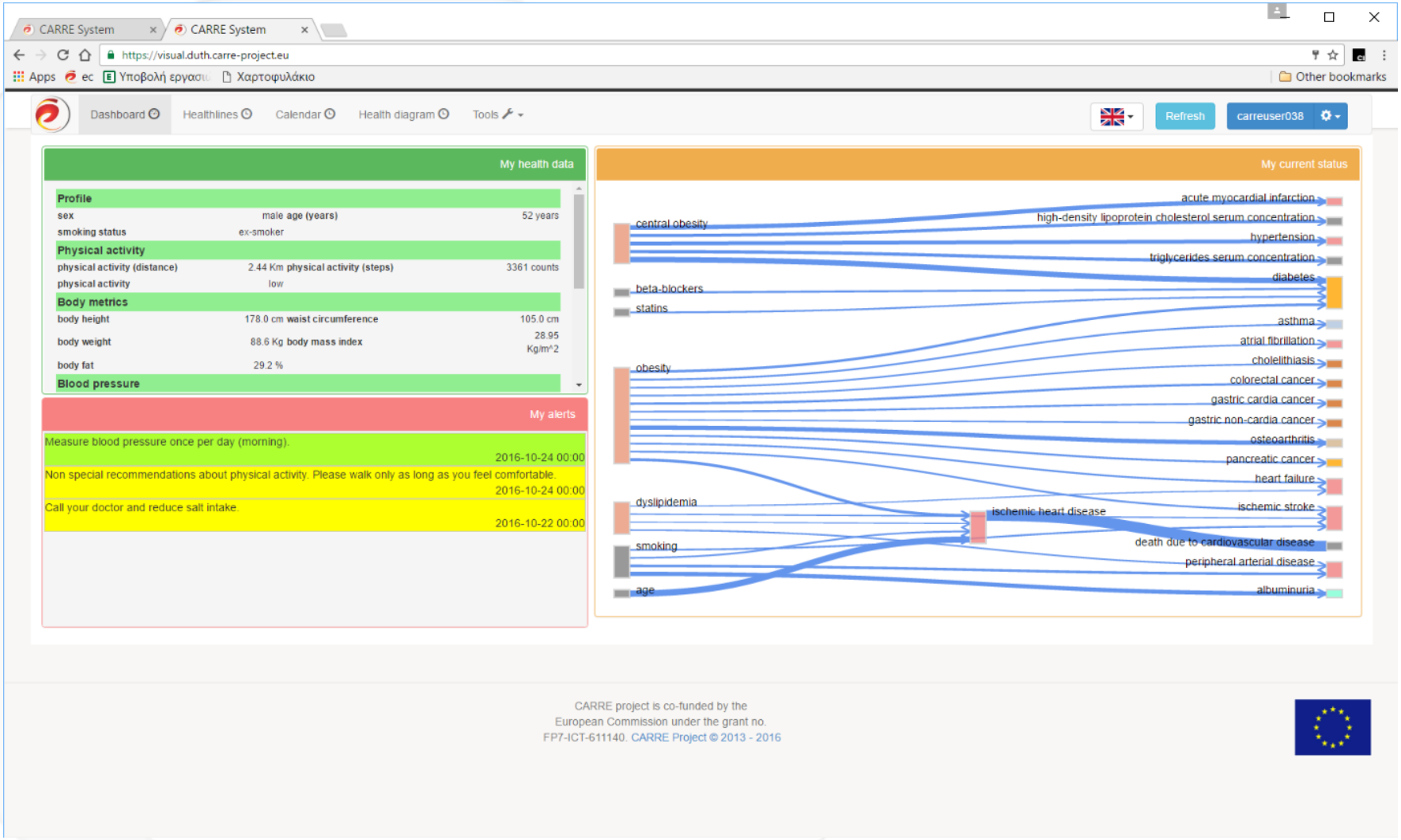


A. Third et al, CARRE D.4.1 & D.4.2, 2015

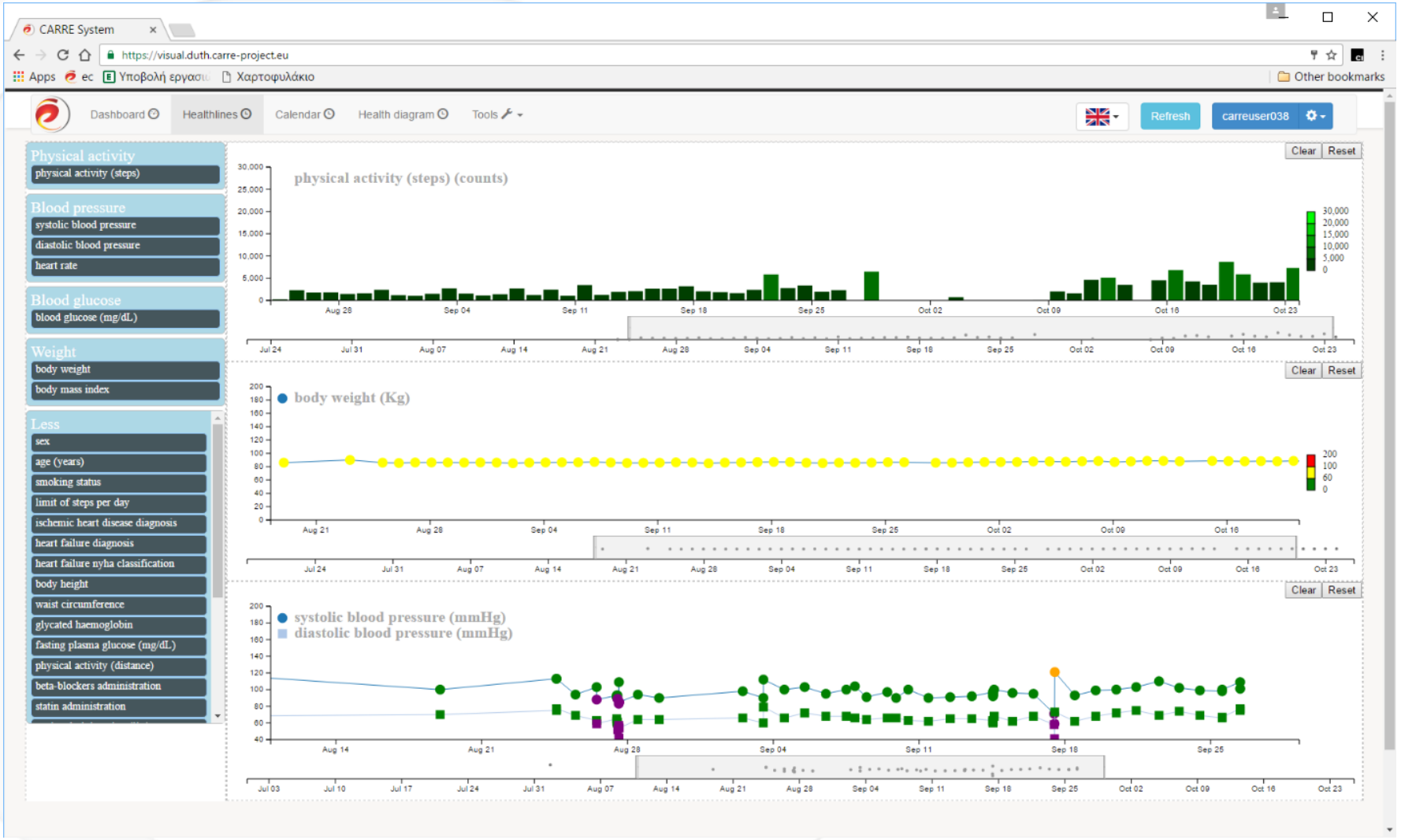
CARRE approach



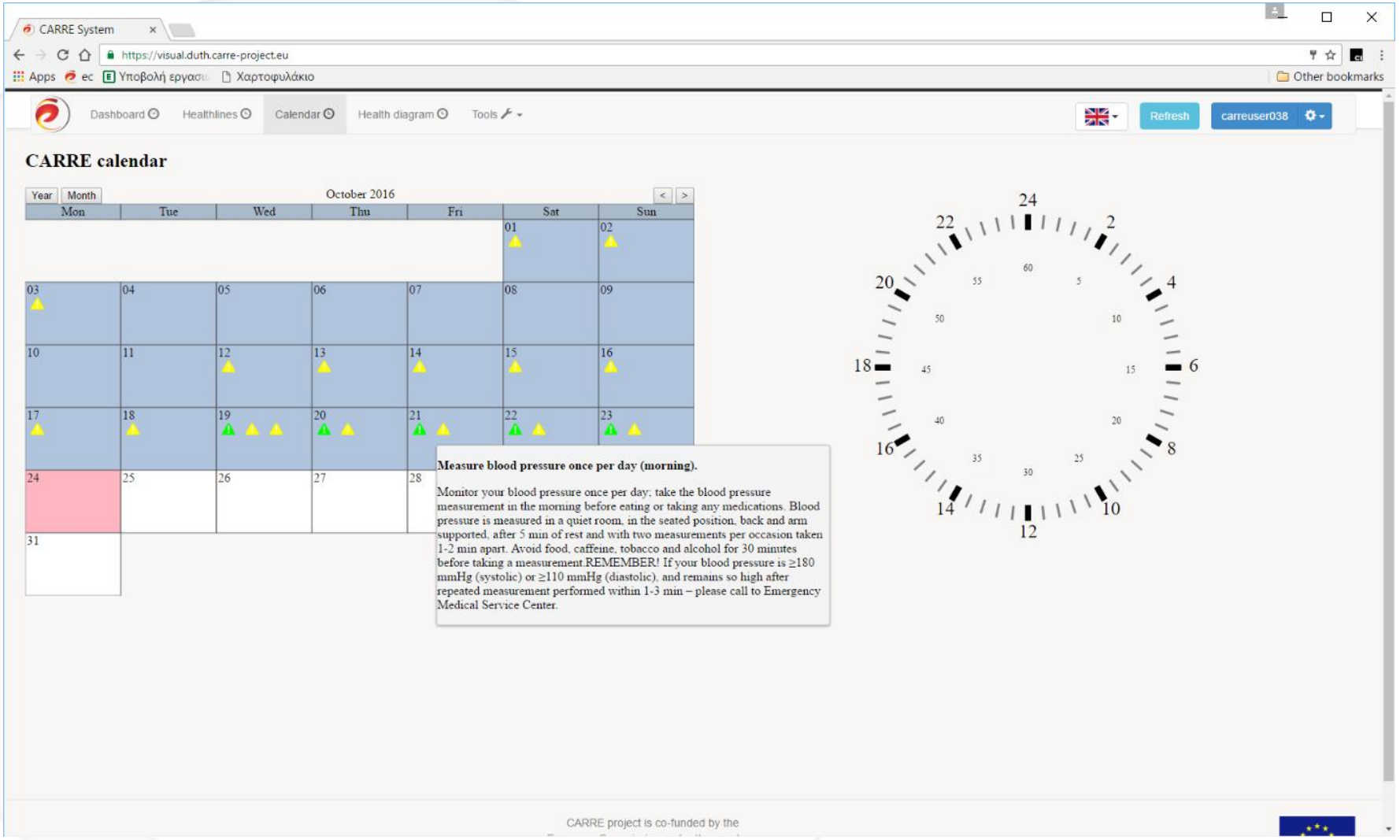
visual analytics for the patient



visual analytics for the patient



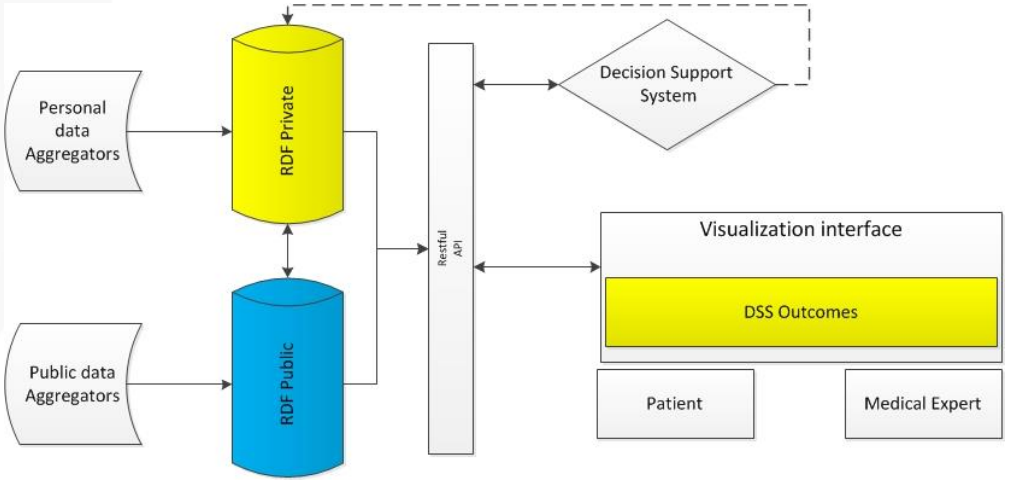
visual analytics for the patient

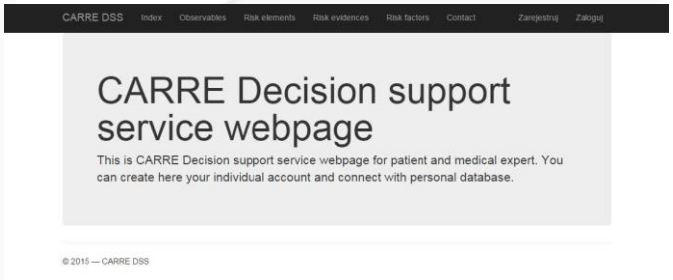


decision support services

interlace personal data and medical evidence for personalized services to

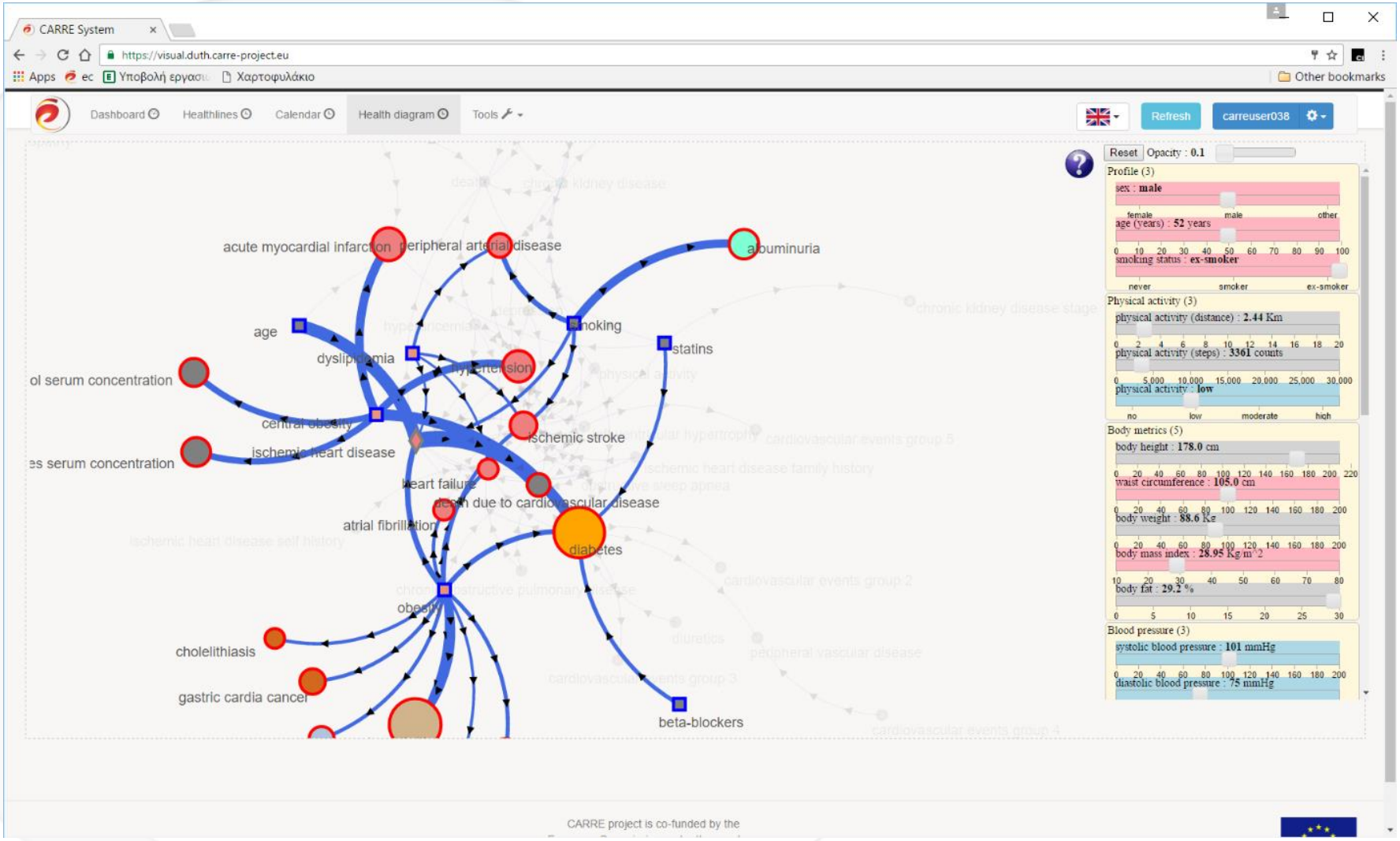
- plan
- monitor
- alert
- educate





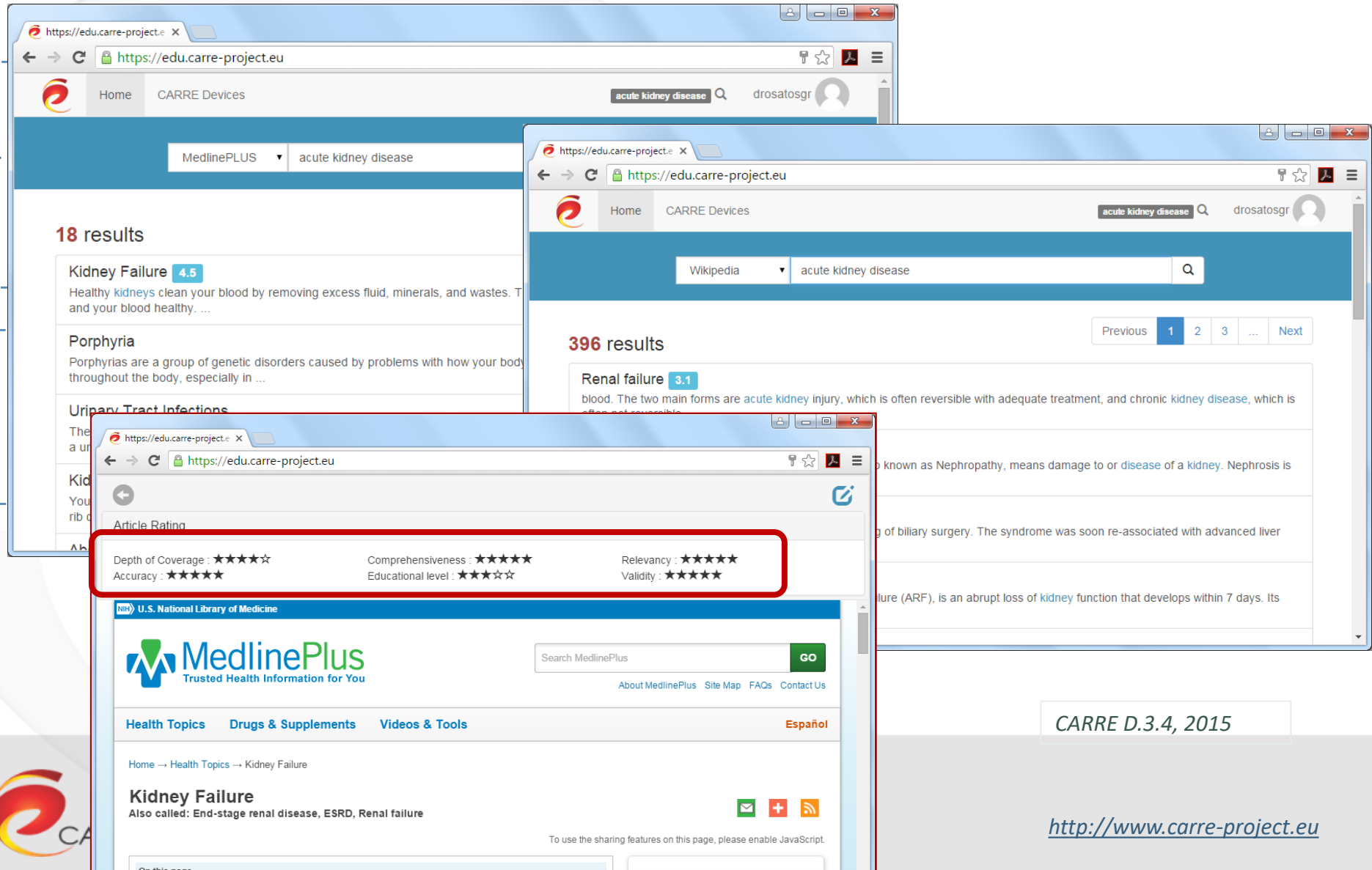
CARRE D.6.2 & D.6.3, 2016

visual analytics for the patient



educational aggregator

https://edu.carre-project.eu/



CARRE D.3.4, 2015

http://www.carre-project.eu

evaluation framework & plan*

	CARRE system functions	Human perspectives			Context and Environment
		Experts	Patients	Admins	
Structure	aggregators and interfaces functioning	changes to working conditions and practices; new skills, & abilities	new skills, and abilities		
Process	service operation correct & valid	induced changes in function and satisfaction	Induced changes in self-management & satisfaction		
Outcome	service usable and reliable	effectiveness	perceived quality of care and life	improving specific clinical parameters	potential to improve the health status and quality of life

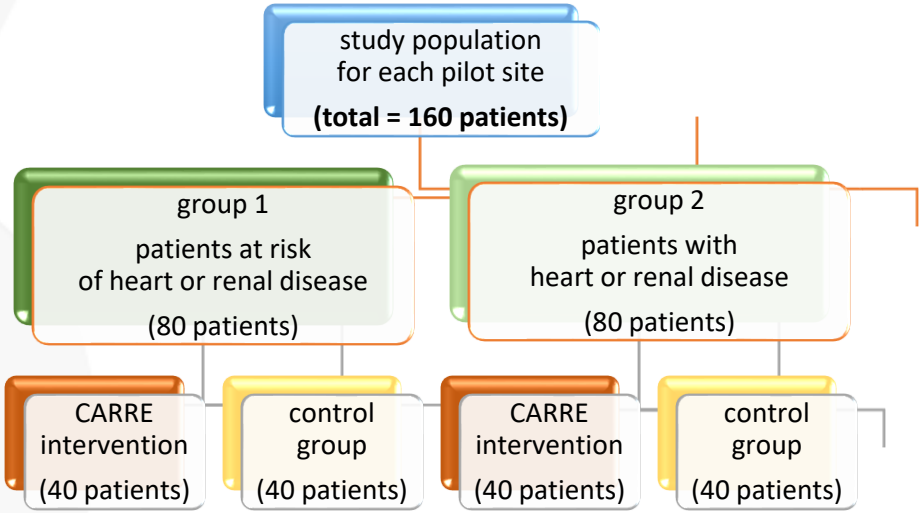
***** *based on the model proposed by Cornford, T., Doukidis, G.I., and Forster, D., Int. J. Manag. Science, 22(5), 491-504, 1994*

1: component testing

2: service testing & understanding

3: service evaluation

evaluation



- 2 center
  randomized control trial

- primary objectives

primary

- increase health literacy
- increase level of patient empowerment *(SUSTAINS instrument)*
- improve quality of life *(SF-36 instrument)*
- reduce personal risk for cardiorenal disease and comorbidities *(biomarkers & disease prevalence)*

secondary

- improve or prevent disease progression *(clinical & laboratory parameters)*
- improve lifestyle habits *(sensor readings)*
- limit no. or dose of necessary drugs *(dose of essential drugs)*
- assess intervention acceptability

CARRE D.7.4, 2016 (in progress)

what?

CARRE

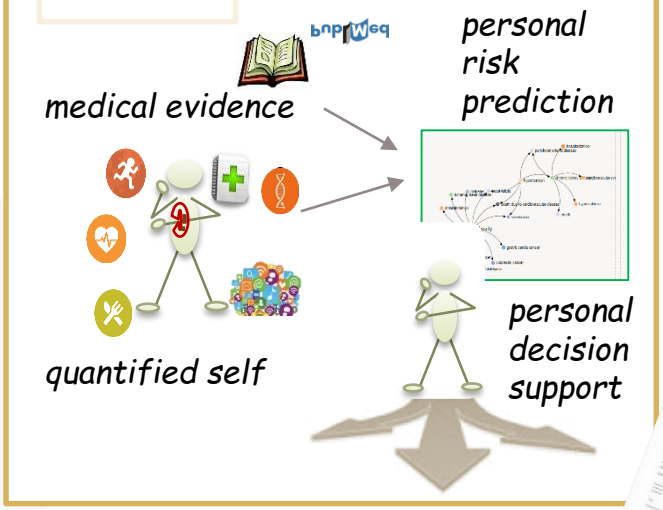
EU FP7-ICT-2013-611140
3.2M, 2013-2016
DUTH, OU, BED, VULSK, KTU, PIAP

why?

cardiorenal disease

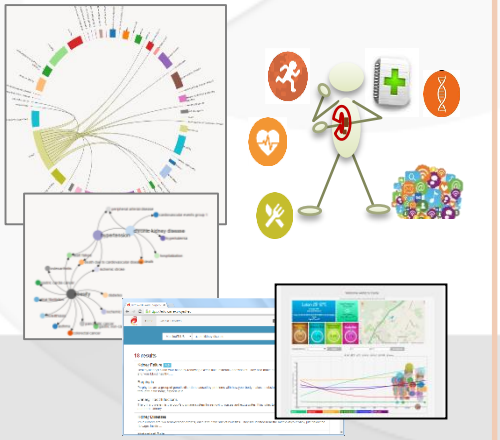
chronic, common, dangerous, expensive, with many causing factors and complex progression

how?



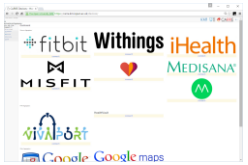
http://carre-project.eu

for the patient

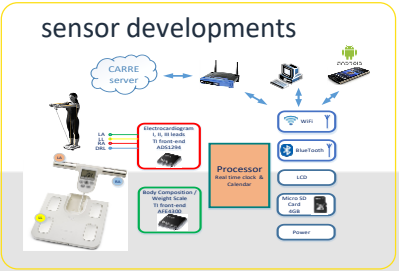


for the medical expert

for the ICT expert



sensor developments



thank you !!!

what?

CARRE

EU FP7-ICT-2013-611140

3.2M, 2013-2016

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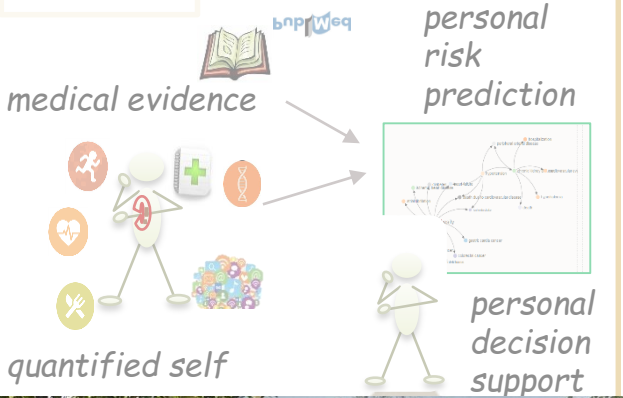
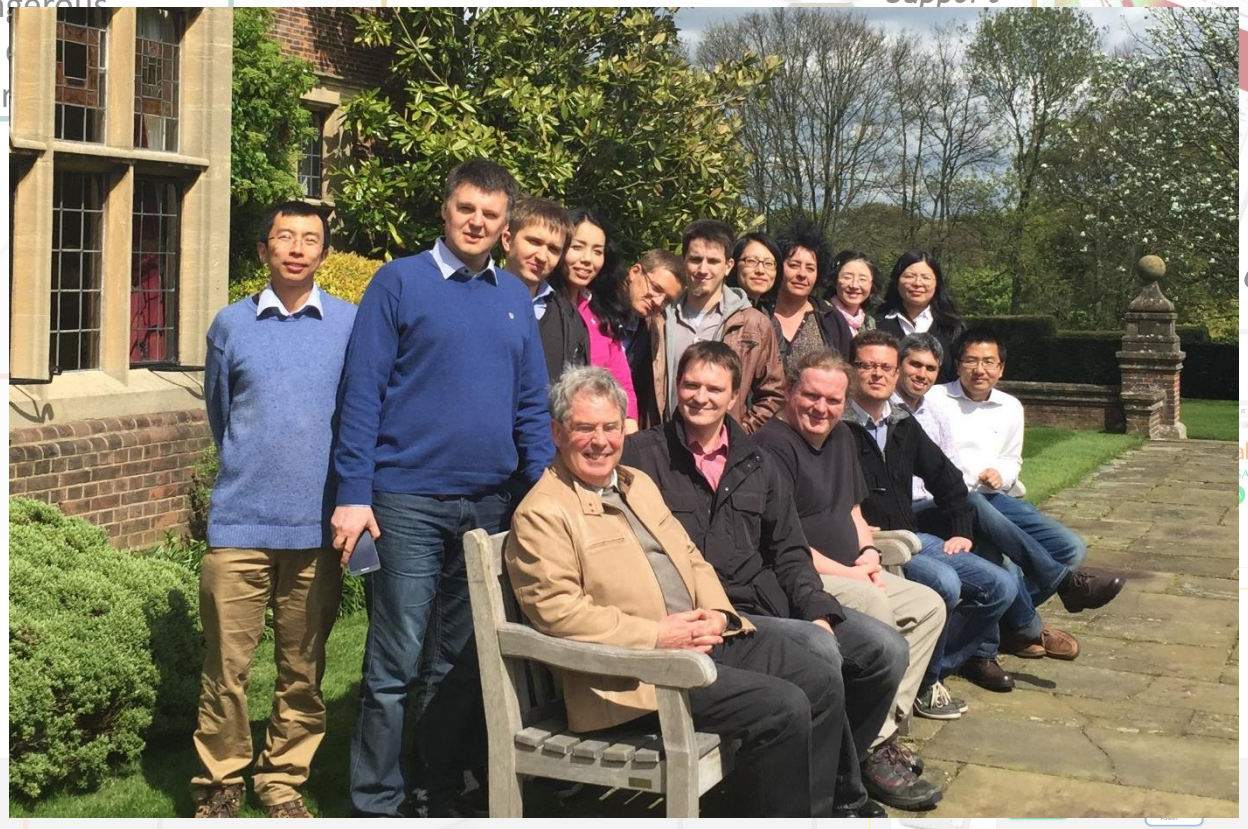
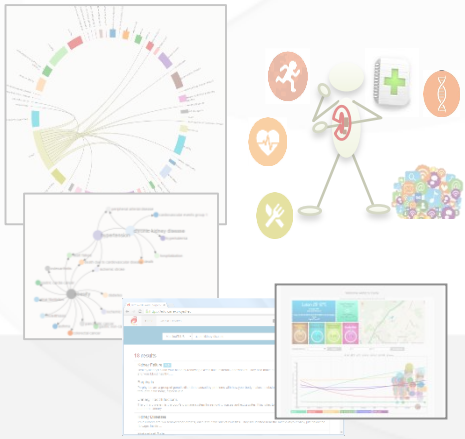




for the patient



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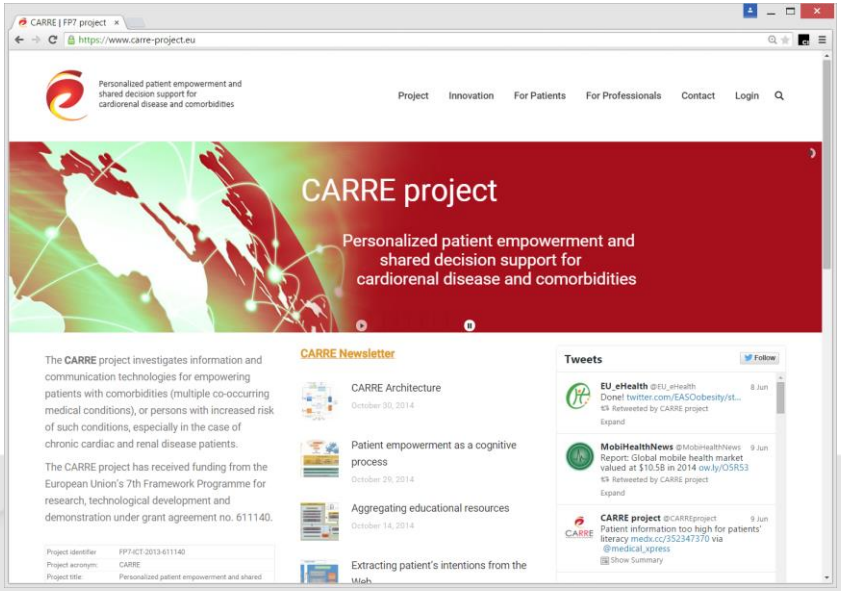
CARRE: Personalized patient empowerment
and shared decision support
for cardiorenal disease and comorbidities

http://www.carre-project.eu/



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