

Aggregating Educational Data for Patient Empowerment

Nick Portokallidis, George Drosatos, Eleni Kaldoudi

School of Medicine, Democritus University of Thrace

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

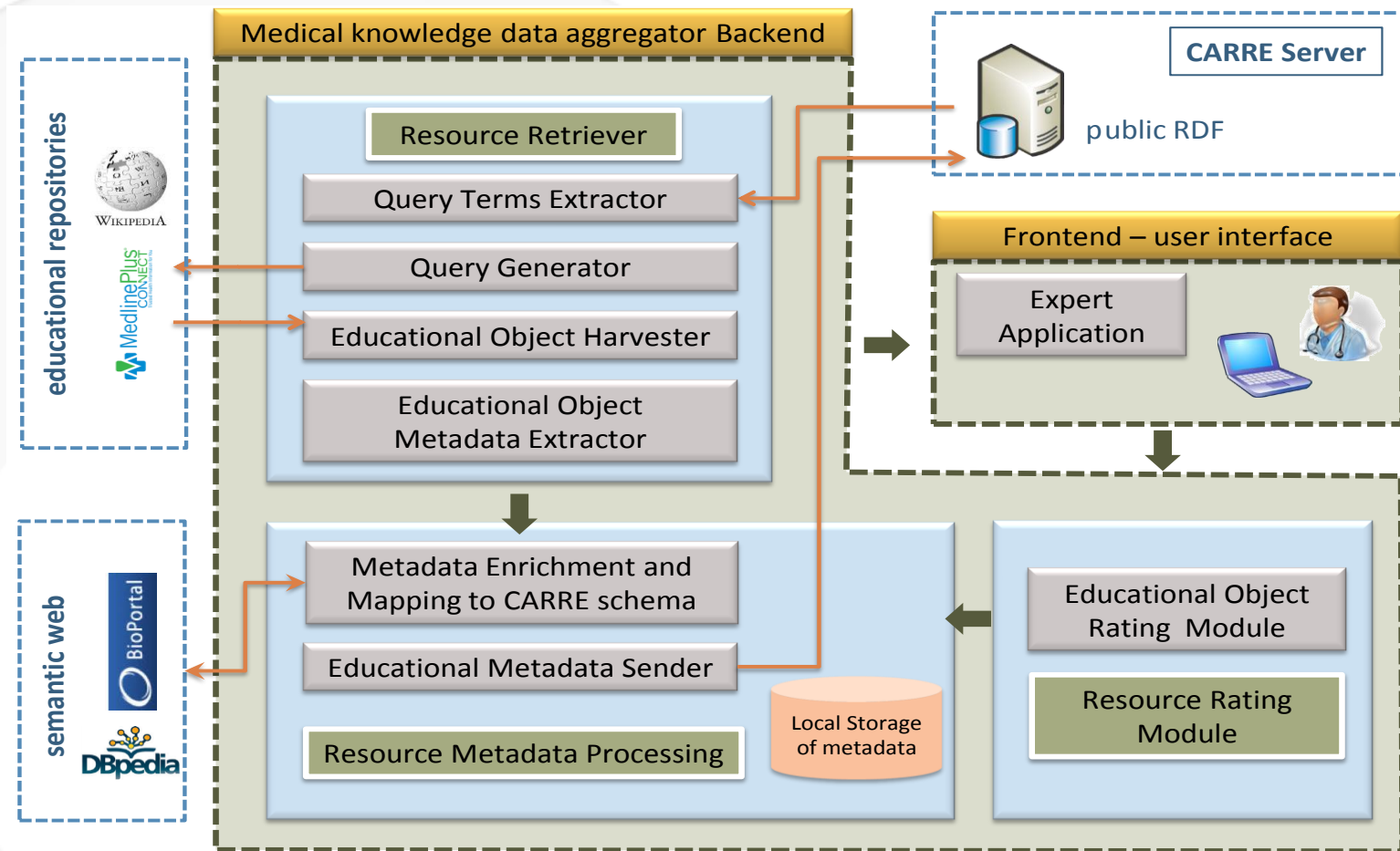
This work was supported by the FP7-ICT
project CARRE (No. 611140), funded in part
by the European Commission.



Multi-source aggregation and annotation

- **Goal:** Educational object aggregation from multiple sources, rated and annotated by experts & patients
- **Possible Resources:**
 - ↪ MedlinePlus
 - ↪ Emedicine
 - ↪ Wikipedia
 - ↪ Healthfinder
 - ↪ WebMD
 - ↪ ...
- **Decided to use:**
 - ↪ MedlinePLUS and Wikipedia
 - include both from authoritative and crowd-source repositories
 - API available, free, CARRE related
 - ↪ Dbpedia, Bioportal for enrichment
 - Dbpedia & Bioportal provide SPARQL endpoint

Component based Architecture



Key Points

- **Personalized patient recommendations on authoritative and non authoritative educational material**
 - ↪ Based on current diagnosis
 - ↪ Based on prediction models regarding current health status
- **Aggregated Educational material that are approved by Medical Experts and rated accordingly**
 - ↪ Protect patients from getting false information
 - ↪ Speed up patient knowledge with more relevant content
- **Allow non-authoritative information in a controlled manner**
 - ↪ Extend patient point of view of a condition
 - ↪ Patients get enough information to protect themselves from medical malpractice

Examples cases

- Recommendations regarding “**acute kidney disease**”
 - ↪ Top 5 related articles
 - ↪ Educational material from authoritative sources
 - ↪ Approved and rated resources from Medical Experts

- Compare sources regarding “**Diabetes**”
 - ↪ Most accurate information
 - ↪ Most complete articles
 - ↪ Most helpful articles found by patient

Summary results for CARRE risk elements

CARRE risk elements	Education material
Atrial fibrillation	12
Obesity	14
Central obesity	19
Dyslipidaemia	19
Age	19
Death	20
Left ventricular hypertrophy	21
Hypoglycaemia	21
Diabetes	22
Acute myocardial infarction	27
Ischemic stroke	28
Depression	30
Cardiovascular disease	32
Heart failure	33
Ischemic heart disease	34
Hypertension	34
Chronic kidney disease	34

Source	Educational Material
wikipedia	71%
Medlineplus	29%

Implementation

(Open Source)

- **Frontend Aggregator** as a web application
 - ↪ Desktop PC
 - ↪ Mobile / Tablet
- **Backend Annotator** as a SPARQL query service
 - ↪ NodeJS server

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The screenshot shows a web application interface with a search bar containing 'chronic kidney disease'. Below the search bar, there are 43 results. The results are displayed in a list format with the following items:

- Chronic Kidney Disease**
You have two kidneys, each about the size of your fist. Their main job is to filter wastes and excess water out of your blood to make urine. They also keep ...
- Kidney Failure**
Healthy kidneys clean your blood by removing excess fluid, minerals, and wastes. They also make hormones that keep your bones strong and your blood healthy. ...
- Dialysis**
When your kidneys are healthy, they clean your blood. They also make hormones that keep your bones strong and your blood healthy. When your kidneys fail, ...
- Kidney Diseases** 3.5
... blood pressure, or a close family member with kidney disease. Chronic kidney disease damages the nephrons slowly over several years. ...
- Parathyroid Disorders**
Most people have four pea-sized glands, called parathyroid glands, on the thyroid gland in the neck. Though their names are similar, the thyroid and parathyroid ...
- Anemia**
If you have anemia, your blood does not carry enough oxygen to the rest of your body. The most common cause of anemia is not having enough iron. Your body ...
- Diabetic Kidney Problems**
If you have diabetes, your blood glucose, or blood sugar, levels are too high. Over time, this can damage your kidneys. Your kidneys clean ...

Implementation

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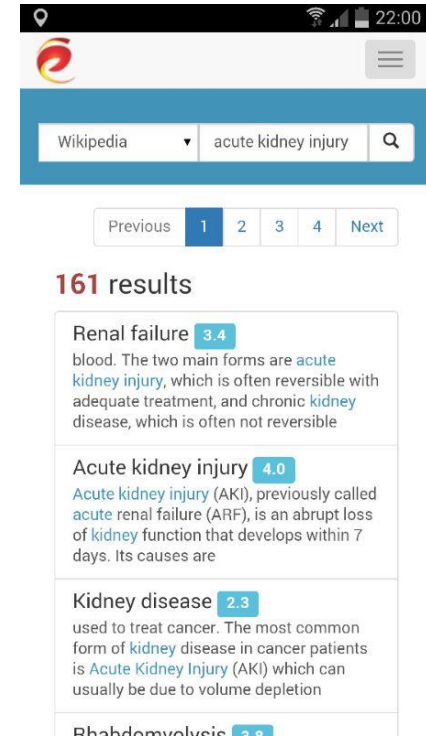
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The screenshot shows a Wikipedia article titled "Chronic kidney disease". At the top, there is an "Article Rating" box with the following metrics: Depth of Coverage: ★★★★★, Comprehensiveness: ★★★☆☆, Relevancy: ★★★★★, Accuracy: ★★★☆☆, and Educational level: ★★★☆☆. Below the rating, the article title "Chronic kidney disease" is displayed, followed by the text "From Wikipedia, the free encyclopedia". The main text of the article begins with "Chronic kidney disease (CKD), also known as chronic renal disease, is a progressive loss in renal function over a period of months or years. The symptoms of worsening kidney function are not specific, and might include feeling generally unwell and experiencing a reduced appetite. Often, chronic kidney disease is diagnosed as a result of screening of people known to be at risk of kidney problems, such as those with high blood pressure or diabetes and those with a blood relative with CKD. This disease may also be identified when it leads to one of its recognized complications, such as cardiovascular disease, anemia, or pericarditis.^[1] It is differentiated from acute kidney disease in that the reduction in kidney function must be present for over 3 months." The article continues with information about diagnosis and treatment. On the right side, there is a section titled "Chronic kidney disease" with a photograph of a person's forehead and scalp showing uremic frost. Below the photo, there is a list of "Classification and external resources" including ICD-10 (N18), ICD-9 (585.9, 585.1-585.5, 403), DiseasesDB (11288), MedlinePlus (000471), eMedicine (article/238798), Patient UK (Chronic kidney disease), and MeSH (D007676).

Implementation

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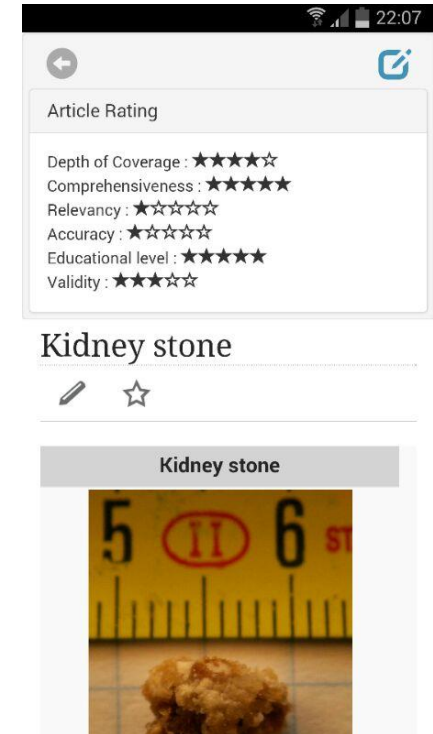
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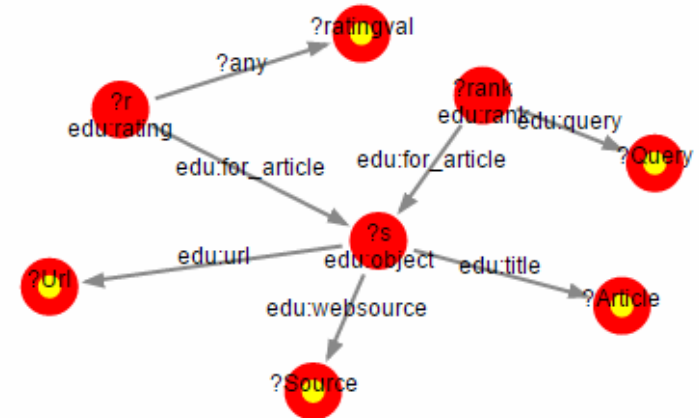
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- **Online RDF data demonstration:** <http://goo.gl/qVeVoE>
- **Online Video demonstration:** <http://youtu.be/vuu-1n0KVNc>



Thank you!

- try the Aggregator at:

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

- download the source from:

<https://github.com/telemed-duth/carre-edu>

Acknowledgement



This work was supported by the FP7-ICT project CARRE (No. **611140**), funded in part by the **European Commission**.



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

CARRE Project website: <http://www.carre-project.eu>