Aggregating Educational Data for Patient Empowerment

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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

- Medical knowledge data aggregator Backend
  - Resource Retriever
  - Query Terms Extractor
  - Query Generator
  - Educational Object Harvester
  - Educational Object Metadata Extractor
  - Metadata Enrichment and Mapping to CARRE schema

- Frontend – user interface
  - Expert Application
  - Educational Object Rating Module
  - Resource Rating Module

- Local Storage of metadata

Educational repositories:
- Wikipedia
- MedlinePlus

Semantic web:
- BioPortal
- DBpedia

CARRE Server

public RDF

Resource Metadata Processing

Educational Metadata Sender

Educational Metadata Rating Module

Aggregating Educational Data for Patient Empowerment
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

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

### Source

<table>
<thead>
<tr>
<th>Source</th>
<th>Educational Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>wikipedia</td>
<td>71%</td>
</tr>
<tr>
<td>Medlineplus</td>
<td>29%</td>
</tr>
</tbody>
</table>
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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- Online RDF data demonstration: [http://goo.gl/qVeVoE](http://goo.gl/qVeVoE)

- Online Video demonstration: [http://youtu.be/vuu-1n0KVnc](http://youtu.be/vuu-1n0KVnc)
Thank you!

- try the Aggregator at:
  
  [https://edu.carre-project.eu](https://edu.carre-project.eu)

- download the source from:

  [https://github.com/telemed-duth/carre-edu](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