Holistic Health Records and Big Data Analytics for Health Policy Making & Personalized Health

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WS3-Big Data For Precision Medicine Symposium
Agenda

- Vision
- The CrowdHEALTH story
- Key enabler
- Objectives & propositions
- CrowdHEALTH architecture
- Use cases
- Summary
"Collective wisdom driving public health policies"

Today

- Numerous health ICT services
  - Several health services
  - Limited data exploitation
  - Inefficient personalization in health care provisioning
  - Health records (EHRs & PHRs) of specific value
  - Ineffective, untargeted, and fragmented health policies

Tomorrow

- Health policies exploiting big data
  - Heterogeneous data sources integration
  - Holistic health records (HHRs)
  - Data analytics on aggregated data
  - Collective knowledge exploitation
  - Multi-modal targeted policies
The CrowdHEALTH Story

Current Approaches

- Independent and heterogeneous services
- Limited data exploitation
- Health Records (EHRs & PHRs) of limited value

Specific Health Policies

- Ineffective and untargeted health policies

(a) Fragmented Health Strategies
(b) Inefficient personalized health care

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The CrowdHEALTH Story

CrowdHEALTH Platform

- Wearables & Smart devices
- Public Health Organizations
- Health Clinics
- Doctors & Physicians
- Laboratories
- Patients
- Radiologists
- Payers

Social care data
- Medical device data
- Personal data (health, social, lifestyle)
- Laboratory medical data

Healthcare data

Security Framework

Big Data Platform

- Data Cleaning
- Information Aggregation
- Situational Knowledge Acquisition & Analysis
- Data Anonymization
- Data Visualization
- Risk Assessment & Stratification
- Causal Mechanisms Analysis
- Forecasting
- Simulation, Experimentation & Evaluation

HHRs

Experience & Relationships with other HHRs

Social HHRs

Contextual Information

(a) Public Health Strategies
(b) Personalized Medicine, Healthy Life Support and Disease Prevention

Public Health Policies
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Social HHRs mean HHRs that are enriched / updated with information from other HHRs (their “experiences”) in order to propose health-oriented activities.

Exploitation of collective knowledge by adopting partially or completely elements (care plans, practices, activities, etc) included in other HHRs
- Based on clusters of different elements – e.g. nutrition-related
Objectives, Innovations & Propositions (1/3)

HHRs & Social HHRs

 ► Objectives:
  ▪ Exploitation of heterogeneous data sources and compilation of collective knowledge through Social HHRs.
  ▪ Ensuring secure cross-sector and multi-actor data exchange.

 ► Innovations:
  ▪ Compilation of collective knowledge for the provision of efficient public health policies and services.
  ▪ Creation of a security framework for trust management, adaptive selections, data anonymization, access control, and authorization.

Propositions

  ▪ HHR structures enabling capturing of different data
  ▪ Contextual analysis tools
  ▪ Clustering / classification technologies for analyzing HHRs and their networks / HHRs clusters
  ▪ Users’ preservation, and data integrity techniques
  ▪ Access control schemes
Objectives, Innovations & Propositions (2/3)

Data Management

► Objectives:
  ▪ Facilitating new insights to healthcare by exploiting all available data sources.
  ▪ Data visualization for analyzing outcomes in a meaningful and proficient way.

► Innovations:
  ▪ Provision of added value real-time HHRs and health policies.
  ▪ Incremental data visualization techniques delivering data analytics outcomes.

Propositions
  ▪ Big data LeanXcale platform
  ▪ Dynamic data sources integration technologies
  ▪ Data cleaning and sources reliability techniques
  ▪ Data aggregation mechanisms (feeding HHRs)
  ▪ Data monitoring and visualization workbench
Objectives, Innovations & Propositions (3/3)

Health Policies

- **Objectives:**
  - Modelling, creation and co-innovation of multi-modal health policies.
  - Evaluation and adaptation of cross-domain policies.

- **Innovations:**
  - Dynamic knowledge extraction through data deriving from data sources, social HHR networks, and predictive risk/causal analysis, with respect to all health determinants.
  - Dynamic knowledge extraction through the outcomes of simulations and evidence based approaches.

- **Propositions**
  - Structural representation including several KPIs
  - Health analytics (algorithms)
    - Prediction / forecasting
    - Clinical pathways
    - Risk identification
    - Causes analysis
  - Identification of closed groups for simulations
  - Evaluation of policies from closed groups
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Various deployment patterns / multi-modal policies

Centralized deployment & processing
(might imply the need for data sharing across local deployments)

Derived knowledge
(realizes “data sharing” across providers?)

Local deployment & processing
(hospitals, medications centers – e.g. KI / HULAFE)

Local deployment & processing
(online tools / platforms – e.g. BioAssist, ...)

Local deployment & processing
(new NON-EXISTING use case partner)

Different data stores in (different) organisations

National / International Policies
(centralized deployments-based)

Local / Regional Policies
(distributed deployments-based)
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5 Use Cases – 6 Pilots

- Medication centres
  - HULAFE & KAROLINSKA
- Monitoring of Chronic diseases
  - BIOASSIST
- Social networks
  - CARE ACROSS
- Living labs
  - DFKI
- Public environments
  - UNI LJUBLJANA

CrowdHEALTH
Health Department of La Fe in Valencia - Overweight and obesity

- Obesity prevalence of 15% in the region -> 45,000 people who could benefit from more efficient policies and interventions.
- HHR Clinical Attributes:
  - Laboratory test results
  - Hospital resource utilisation: outpatient consultation, emergency room visits, hospitalizations, hospital at home episodes
  - Morbidities
- Mobile App for measuring body parameters (Height, Weight, BMI, and others).

Karolinska – CVD

- VAL database: EHRs from all the registered hospitals in Stockholm.
- SwedeHeart quality registry which contains EHRs only for patients diagnosed with cardiovascular disease.

SwedeHeart quality registry ([http://www.ucr.uu.se/swedeheart/](http://www.ucr.uu.se/swedeheart/))
Public health data

- **SLOfit** is implemented in all Slovenian schools
- Covers the entire population of children from age 6 to 18: In practice, over 220,000 children are measured every year in April
- SLOfit database today includes over 7.5 million sets of measurements of around 1,000,000 people, which is a half of entire population of Slovenia.
- The SLOfit test battery includes 3 anthropometric measurements and 8 motor tests.
- Based on the results of the 8 motor tests, Physical Fitness Index is calculated as a measure of overall physical effectiveness of every child.

CareAcross – On line Coaching for cancer patients

- Driven by the data entered by cancer patients on the secure CareAcross web platform
- Information on their diagnosis, treatment, co-morbidities, health behaviours and side-effects.
- The platform then provides medical information based on this input, and attempts to “coach” the patients into behaviour change based on medical research.
- Examples of aggregated Data
  - % of users who adhere to the coaching advice
  - % of users who remain engaged with the platform
  - % of users who report specific side-effects
Lifestyle data – Combined with EHR and Social data

- Activity and nutrition tracking devices developed and provided by DFKI
- Complementing the health records kept at HULAFE
Chronic Disease Monitoring Data

- Supported by the Heartaround app provided by BioAssist
  - Biosignal Collection and Homecare Telemonitoring
  - State of the Art Communication Facilities
  - Emergency Response
- User friendly UI (contactless measurements)
- Involvement of multiple stakeholders, incl. Attending doctors, Relatives, Friends, Pharmacists, etc.
- Integration with EHR - Associated with Bioiatriki SA (2M EHRs)

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## Supported Wearable Devices in Heart Around App

<table>
<thead>
<tr>
<th>Category</th>
<th>Devices</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oximeters</td>
<td>Jumper JPD-500F</td>
</tr>
<tr>
<td>BP Monitors</td>
<td>Beurer BM85, iHealth Track, A&amp;D UA-651BLE</td>
</tr>
<tr>
<td>Spirometer</td>
<td>MIR Smart One</td>
</tr>
<tr>
<td>Weighing Scales</td>
<td>iHealth lite, Beurer BF800</td>
</tr>
<tr>
<td>Activity Tracker</td>
<td>H10Pro</td>
</tr>
<tr>
<td>Glucose meters</td>
<td>iHealth BG5, Contour NextOne, Philips DL8740</td>
</tr>
<tr>
<td>Body Temperature</td>
<td></td>
</tr>
</tbody>
</table>

Available: [http://www.heartaround.com](http://www.heartaround.com)
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Thank you!