Personalized Health Knowledge Graph

Amelie Gyrard[1], Manas Gaur[1], Krishnaprasad Thirunarayan[1], Saeedeh Sherkapour[2], Amit Sheth[1]
[1] Ohio Center of Excellence in Knowledge-enabled Computing (Kno.e.sis), Wright State University, Dayton, Ohio, USA
[2] University of Dayton, Ohio, USA

First International Workshop on Contextualized Knowledge Graphs
October 9, Co-located with ISWC 2018

2018 Connections in Smart Health Workshop

Objective

=> Need for "Personalized Preventive Coach Applications" to support clinicians in understanding asthma symptoms and their causes

Context-Awareness

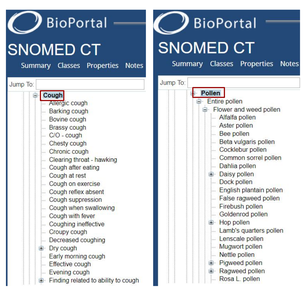
- Context-Awareness refers to the use of external data that can impact the user's situation.
  - E.g., for Asthma: environmental triggers such as air pollution and pollen level.

Personalization

- Personalization adjusts the treatment to each patient's condition.
  - E.g., for severe Asthma patient: determine patient sensitivities (tree vs. grass pollen) and corresponding medication/dosage (rescue vs. inhaled steroids)

KHealth Asthma Ontology (KAO)

- Integration of several ontologies relevant to interpret kHealth datasets
  - W3C Semantic Sensor Networks (SSN/SOSA)
  - Asthma ontologies from BioPortal
  - Weather and smart home ontologies [Staroch 2013] [Kofler et al. 2011]
- Additional ontologies to integrate:
  - SNOMED-CT from BioPortal (e.g., Cough, Pollen concepts)
  - Symptoms Ontology
  - Etc.



kHealth kit

A knowledge enabled analytical framework for **Augmented Personalized Healthcare** (APH) approach involving **continuous monitoring** of chronic disease and its **progression**, and the **patient's overall health**.

kHealth Kit for Pediatric Asthma involves multiple sensors collecting personalized multimodal data (from Clinical notes, mHealth application, PGHD and Outdoor environmental observations)

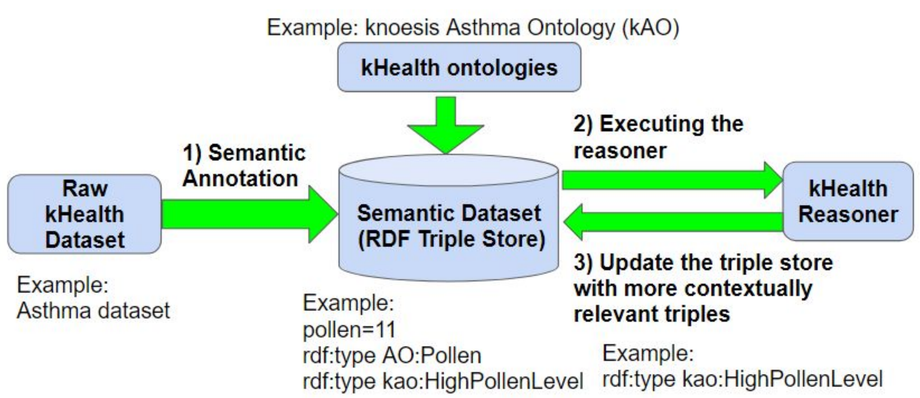
Questions to be answered

- Can we assess the asthma control level, determine patient vulnerability, and medicine compliance?
- Can we reduce the number of asthma attacks through continuous monitoring of the patient's health condition?
- Can we predict the asthma attack based on the data collected about the patient and their surroundings?
- Can we understand the causal relationship between the asthma symptoms and possible factors responsible for them?

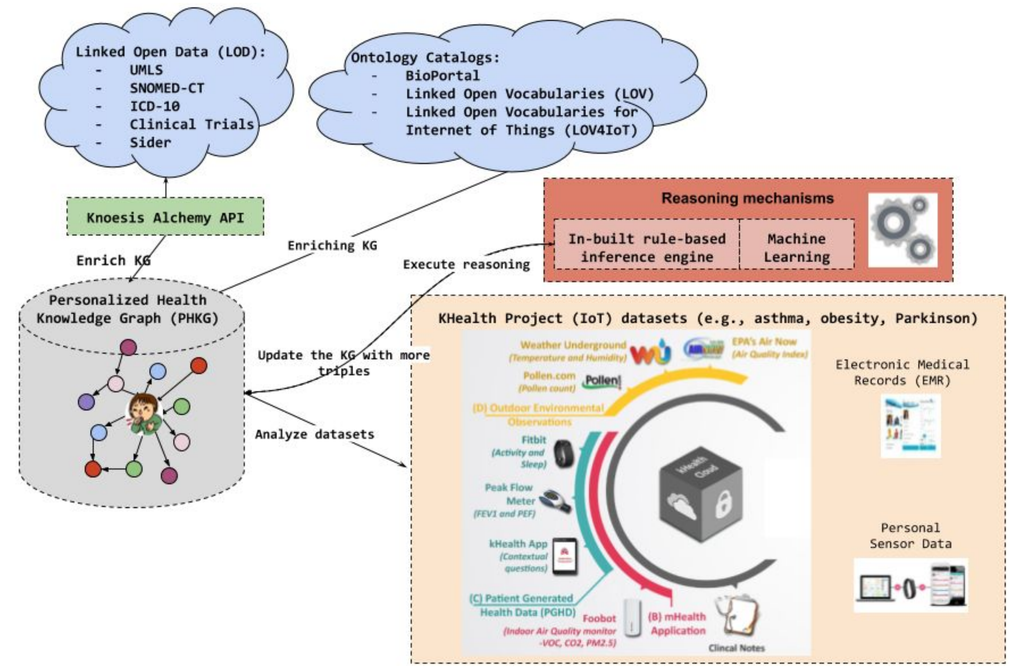
Continuous: Patient Centric Healthcare involving Patient Generated Health Data (PGHD)

- In the ongoing trial involving pediatric asthma patients, we have consented **90 patients out of 150** study cohort.
- The kHealth kit collects **1862 data points patient/day** on 29 different parameters.

kHealth reasoner



Architecture



References

- Amelie Gyrard, Manas Gaur, Krishnaprasad Thirunarayan, Amit Sheth and Saeedeh Shekarpour. Personalized Health Knowledge Graph. 1st Workshop on Contextualized Knowledge Graph (CKG) co-located with International Semantic Web Conference (ISWC), 8-12 October 2018, Monterey, USA.
- KAO ontology: http://wiki.knoesis.org/index.php/KHealthAsthmaOntology
- Knoesis Health KG: http://wiki.knoesis.org/index.php/KnoesisKnowledgeGraph
- kHealth project: http://wiki.knoesis.org/index.php/KHealth:_Semantic_Multisensory_Mobile_Approach_to_Personalized_Asthma_Care
- Knoesis Alchemy API: http://wiki.knoesis.org/index.php/Knoesis_Alchemy_of_Healthcare
- Linked Open Rules: http://linkedopenreasoning.appspot.com/

Acknowledgement

Research reported here was supported by NICHD of the National Institutes of Health under award number 1R01HD08713201 (PI: Amit Sheth). The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.
Contact: <amit,amelie>@knoesis.org
Thanks to the kHealth team for fruitful discussions and feedback.

National Institutes of Health
Turning Discovery Into Health