

Towards Semantic Modeling of Patient Trajectories for Rehabilitation of Osteoarthritis

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Abstract

This poster paper describes the challenges and opportunities of modeling patient trajectories for osteoarthritis rehabilitation using semantically rich abstractions.

Keywords

osteoarthritis, digital rehabilitation, patient trajectories, semantic modelling

Extended Abstract

Osteoarthritis of the hip and knees, and chronic low back pain are a massive burden for individuals and society, incurring colossal healthcare costs [1]. According to the Global Burden of Disease 2019 [2], osteoarthritis affects 7% of the population, with women and older adults disproportionately affected. Therefore, detecting and monitoring osteoarthritis hallmarks for prevention and clinical decision support is crucial for reducing healthcare costs and improving quality of life [3].

The GLA:D initiative [4] is an international treatment program for hip and knee osteoarthritis. Following international recommendations, GLA:D promotes patient education and proposes neuromuscular exercises, avoiding unnecessary surgical interventions. In this context, this paper describes the challenges and opportunities of a novel approach for personalized support targeting persons with osteoarthritis (or at risk). This approach is based on modeling patient trajectories, represented through semantically enriched concepts, which can feed from existing osteoarthritis datasets to tailor individual needs. Given the differences among people potentially affected by osteoarthritis, it becomes necessary to use existing data to better tailor recommendations, guidance, and support. To this end the following challenges must be addressed:

- *Domain modeling*. No ontology exists regarding modeling indicators of rehabilitation for

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hips or knees. Therefore, elaborating on a semantic meta-model will be necessary, while reusing existing specialized vocabulary.

- *Active data acquisition.* Using existing datasets like the GLA:D registry, different features can be extracted, leading to evidence-based recommendations. Nevertheless, a detailed analysis of these features and their impact on osteoarthritis risk would need to be analyzed and represented as ontology instances. Using digital data acquisition tools (e.g., mobile App questionnaires) based on standards osteoarthritis assessment instruments [5] can be used as a starting point to build an osteoarthritis Knowledge Graph.
- *Temporal analysis.* The evolution of patients, with respect to different metrics, including those related to pain, physical ability, and quality of life, could be analyzed to recognize patterns and correlations with periodic assessment results, which might be represented as temporal semantic embeddings in the graph.
- *Patient clustering & recommendation.* Using retrospective data such as the GLA:D registry, individual trajectories can be grouped, potentially identifying common courses of action and proposing therapies that may contribute to the prevention of further deterioration.
- *Privacy protection.* Considering the personal nature of these data, it is of utmost importance to guarantee the anonymity of participating patients, so that their data cannot be used beyond what they consent to. Thus the patient trajectory knowledge graph must incorporate explicit strategies for enabling the protection and anonymization of data.
- *Usability.* The digital solution provided for the patients should incorporate user experience principles to target not only the interface but also to customize the interactions, so that they are not burdened by recommendations or overloaded by information about osteoarthritis.

Digital rehabilitation can substantially enhance patient support, guidance, treatment, and follow-up, saving costs and improving the quality of life for patients with osteoarthritis conditions.

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