Purpose: To describe the benefits of the use of an ontology (a semantic description of concepts, properties, and relationships) as the base of a data management system which provides the (often missing) connecting information regarding goals and process used for patient management.

Method and Material: The ontology has been defined with an OWL ontology model using Protégé and Oracle. The ontology database consists of the ontology model and the instances (actual data). Supporting code which forms the distributed components is written in Java, C, C++, and Fortran. Messaging between components uses an open-source AMQP broker. To retrieve and update data, SPARQL queries are messaged to the ontology access components.

Results: Initial ontology construction has been based on standard and departmental concepts. Guidelines used include making the ontology of sufficient (and extensible) scope to tie together key concepts with enough depth to be useful for study retrieval (queries), and with enough attribution to identify related source material (files, URLs, other databases, PACS…) when additional detail is desired.

Integration of this new knowledge-modeling mechanism into our clinical/research infrastructure framework is underway. Current efforts focus on modeling and implementing more sophisticated management of planning and delivery for adaptive therapies based on biomarker assessments that identify or predict changed response to the dose received during treatment. In these complex protocols, treatment plans must be organized by treatment directives that specify treatment goals, must include detailed knowledge of prior treatment, and manage all new patient-specific data acquired during the treatment course.

Conclusions: An ontology-based knowledge base has been developed as the information framework of a new treatment planning and workflow management system. This ontology provides the extensible means to describe and manage highly complex adaptive treatment protocols for unique and advanced clinical studies.

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