

User Interaction Outline - for Translational Medicine Ontology

This outline is a collaborative work within the interest group HCLS in W3C. It will be moved to the wiki when convenient!

Introduction

This document is an outline for discussion at a TMO call in February. Expected outcome from the discussion is a plan to develop a mock-up or pilot of a physician/researcher user interface (UI) that highlights the opportunities provided for by the TMO. We aim to introduce UI concepts, key expectations/requirements/opportunities that exhibit realistic goals and demonstrate potential applications in accordance with the TMO.

This document is based on work within TMO during the autumn of 2009. We will use the physician use case for this work.

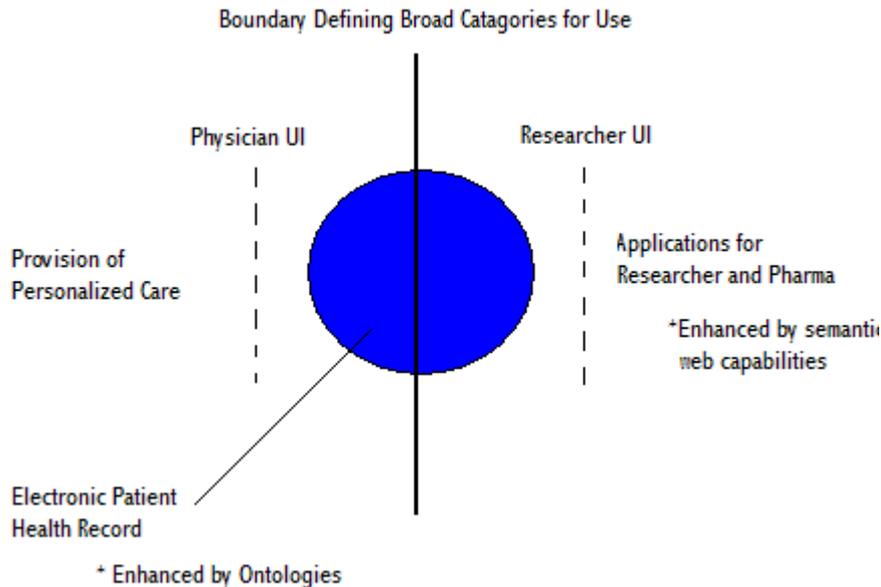
Use Case

We propose two broad categories for application of the UI : 1) provision of personalized care in a clinical setting 2) use for research/pharma purposes as a platform for clinical hypothesis identification and as a tool for the identification and development of personalized medicine.

Question 1: Are we assuming that the physician is doing/using this during the patient session, and presumably while using whatever EHR system is in place? it wasn't quite clear to me from the use case when the physician would be doing this work, or what the context would be for the most sophisticated actions. (makes a difference in the UI in the end; we'd design differently for different use situations)

The physician continually inputs into the patient's eHR and so do all members of a healthcare group (ie secretary, reception, biochemistry, haematology). Further, each of the members entering should be able to retrieve information from the eHR for individual purpose- relevant to either A)care provision B)research purposes ie. the industry or academic (under appropriate supervision and in accordance with an ethics review panel) C) Audit of care provided D) any other.

It is most desirable that information/links to ontologies/relevant data sources be accessible both from a A) "provision of care" perspective to facilitate the operator to provide superior, evidence-based and personalized medicine to B) a "researcher/pharma" perspective that will enable relevant translational query/hypothesis development and related applications that will improve and streamline our approach to stratified drug discovery.



It is important that information that is keyed into a patient's eHR be "viewable" by others since the underlying record is the same in its unabridged format. An academic, physician, or researcher in any faculty should then be able to query the eHR in **any** way either cross-sectionally or retrospectively to map, sequence, or identify trends in presentation of disease. Some basic examples are :

- response to prescribed drug therapy over time
- pathology progression, imaging, - paired together over time with disease genotype and/or phenotype
- adverse drug reactions that are documented throughout treatment that otherwise would go unnoticed and take excessive time and resource to identify by current systems in place. (I.e. viox - if patients who should not have received the drug, ie. those likely to respond adversely, were identified earlier and quicker, prescribing guidelines could have been changed to **avoid** prescribing in specific patient cohorts, with either genotypic or phenotypic response identified earlier to avoid premature removal from the market. this cost the industry millions. it also left many in the world without an effective and reliable treatment.)
- Practice-changing biomarkers (many of which are already known) can be identified more easily by mapping laboratory parameters to disease presentation progression and resolution over time.(using a patient's eHR) Our interface should facilitate this process with ease.
- Trial design and allocation of appropriate sample populations will hinge on the development of an appropriate and accurate electronic system/mechanism/ interface that will facilitate identification of subjects that are genetically/ phenotypically capable of responding to trial compounds in a positive way. They should also enable researchers to identify who in the subject sample will likely respond adversely to newly administered trial agents. The interface, as a key to mobilize a subject/patient's own specific personal genetic/metabolic/historical variability, can be used by the industry/academic/research physician to allocate consented patients to trial arm based on a much more complex and finite group of key variables that are much more likely to predict success or failure in response to novel compounds in trial.

Discussion topics

UI - Objectives, to be discussed at TMO call

(A) Demonstrate how the TMO makes it possible to interact with the same data from many disparate user categories. Data : A patient's medical record and all of the data contained therein. Images, xrays, pathology reports, demographics, drugs, medical conditions, biochemistry, etc...

(B) Demonstrate "Semantic Interoperability", i.e. how human and computers can utilize/understand/interpret data independent of the provider

(C) Demonstrate how a physician can utilize TMO to fortify their ability to provide personalized care.

(D) Demonstrate how TMO can aid researchers/pharma/physician identify associations and develop hypotheses to facilitate drug discovery and related applications

(x) More objectives ...

UI - Requirements, to be discussed at TMO call

"User Interaction for an Information Echo System in Translational Medicine"

(1) One group of data spanning bedside to bench with many "Interfaces" gaining access to that data

(2) User Interaction - scientists expect a dialog where they can contribute with their own knowledge (and offer relevant amendments/additions to data)

(3) Flexible / adjustable, We expect an iterative process where users different needs to enter

data, query, mine/browse, visualize and search the semantically data can be met. **It is critical for us to express and highlight -**

users are multiple, and information they seek differs vastly with respect to speciality within the translational hierarchy - physicians look for things relevant to diagnosing while scientists look for fine detail relevant to their individual field and use clinical presentation data to match/correlate with parameters in question ie. radiologic data - A GP is less concerned with hippocampal sizes, whereas an academic studying hippocampal sizes is interested primarily in this type of data and would like to mine it from patient records and describe its relevance and correlation - although the interface they use may differ entirely for functional reasons, the underlying ontology/patient record MUST BE THE SAME)

(x) More requirements ...

Question, should we evolve existing solution or propose a new?

Question, should we aim for two different interfaces?

Eric note: I could go either way. The two big unknowns in my mind: the specific piece(s) of information to be displayed, and the exact context for use. Context would depend on the interaction setting and the time and mindshare available to the practitioner for the interaction. A physician doing end-of-day chart reviews alone in the office would have a lot more ability to focus on a unique UI, while a physician engaged with a patient in an examination room wouldn't have the time, presumably. As for the specific information, I think it would be helpful for me to understand (1) exactly what data are part of the various interaction points described in the use case, and (2) how much familiarity with the structure and presentation of data we can assume on the part of the physician; example, in step 7 of the use case, would the physician easily understand the SNP profile? Hope this makes sense.

A clinician needs a simple interface, easy to use, and focused to filter and provide brief input when called for, and to function in a pure and basic sense when he/she chooses to rely on gut instinct. This interface must be capable of providing everything we list in <http://esw.w3.org/topic/HCLSIG/PharmaOntology/UseCases> (remember **most physicians only recently learned how to use the computer for the provision of clinical care in the past 5 years** and to ask them to integrate and use an ontologic/semantic approach with associated " bells and

whistles" will be like asking a person with dementia to calculate the GDP and apply it to infrastructure remodeling. Sense is not common.

Physicians do however need an integrated, evidence based, interface to enable them to provide personalized care. It must function on a basic and easy-to use interface. They do not need to know or see SNP data that is "raw data" however they need to see relevant SNP data that has already been reviewed - ie. data on SNP relationships that have been proven and are new to practice, ie. those that have been peer reviewed and can provide guidance to the way they treat patients. what they dont want to see, are every SNP relationship on the WWW. They would however want to be made aware of the growing list of 40-50 drugs listed by the FDA with genomic/biomarker data that has been incorporated recently to guide the prescribing of specified preparations. They must be able to pair this available data to an individual patient's genomic data/biomarker profile to ensure safe and effective prescribing of specified agents already on the market.

All other uses - research - academic clinicians - trial design - audit etc... : The interface does not matter to a researcher as much as it matters to a clinician who has little time to manipulate its functions.

Key : Remember that the underlying patient profile (eHR) is the same to all users and contains the same unabridged information. The interface, while simplicity is always good when possible, should be focused more on task performance and query power or "minability". It should enable a user (any member of the translational team - we list these in roles) to answer ANY question about the "data" contained within. The "data" of course, refers to a patient's eHR. The sky is the limit here and the application of this concept are enormous.

Creating new software may be easier, but i think we should be careful as this is costly and these days, were lucky enough to have a patient's medical record in "some type of digital format". Many are still on paper. These "charts" are useless and only mineable on an individual basis. The world is behind. One existing application to add the new opportunities provided by TMO into could be the existing user interface, OPENVISTA, widely spread e.g. in VA centers.

Eric note: integration into existing apps makes sense to me, though the various EHR systems don't have a great reputation for usability... (one of the major hurdles and if exploited properly, a way for us to demonstrate a robust need to harmonize)

UI - Explored Concepts

Question, have we missed any UI concepts?

- Browser interface is a suitable concept for skilled users that "know" what they are looking for. A browser interface could be a useful component in a UI where scientist could browse the "linked data" to find paths to "additional" knowledge. However, the browser concept is not that good for finding "new" knowledge. Pubby [ref] is one good example of a semantic browser. [Pubby](#)
- Search (keyword) is a well established when looking for information. To achieve good results the user must apply a good search strategies and the search system must present the search results in a format useful for the user, e.g. with help of ranking, summarizing, etc. Sindice [refe]is an example of a semantic search system. Predefined questions, static solution that works well where the same query is repeated (with different argument) and the users don't expect flexibility. [Sindice](#)
- Natural language processing (NLP) query interface, can provide a simple interface for non expert users were knowledge in the ontology is used to guide the user. Freya [refe 1] is an example of a NLP interface utilizing the Ontology as support in the user interaction. [Gate](#)
- Predefined questions
- Query builder [SMART](#)

- Faceted navigation such as [Exhibit](#) and [mspace](#), [VisiNav](#), [aTag Explorer](#), [Virtuoso Facet Browser](#)
- Graph navigation like [Cytoscape](#)
- Visualization of the relation between concepts, preferably path in several steps have a potential to answer presently difficult questions. Relfinder is an interesting example. [Relfinder](#)
- Spreadsheet such as [Cambridge Semantics](#)
- Tabs
- Context based "pop-up", se ultralinker

UI - Proposals

UI - Next steps, to be discussed at TMO call

- Mock-up, sample application or add on to existing? Mock-up example, so you can see how I tend to wireframe stuff like this out: here's a sample I had done for Susie a few months back. <http://www.squishymedia.com/client/HCLS/sample.pdf>
- Possible to Collaborate with institution? - potential to develop this idea using a local hospital and a translational medicine team with the wolfson centre for predictive medicine in liverpool. To clear a group of patients with ethics review board - or enroll health care practitioners as sample research subjects ? unsure exactly and create/apply this interface to the real world. We will learn a great deal from this.
- Could we pull together some sample data? Specifically, from the use case, what exact data would be presented to the physician at steps 5, 7, and 10? -

Plan :

- Create a new patient profile in exactly the same format(s) as the previous patients but with more detail and similar to an actual patients medical record. (ie. sequential imaging, biochemistry, biomarker relationships) to enable the development of a UI and provide breadth of data that will need to be dealt with by the UI
- Start with one comprehensive profile (scientific) and in an iterative form develop a first version closely based on TMO. Important for developers to get feedback from users.
- After a UI is created and issues are resolved - attempt to apply interface to real data to demonstrate:
 - realistic
 - functional
 - serve as demonstration of semantic applications to everyday practice and for research
 - highlight and provide several key therapeutic examples to demonstrate the importance
 - attempt to identify and understand by way of trial and error, the exact hurdles necessary to overcome "real world" application

Practical Information

Next Telcon: TBD - Bosse to provide TC details
TMO meeting thursday 4th of Feb

Date for TMO discussion: Propose to put it on the wiki Feb 4 and have the discussion Feb 18

