Knowledge Management in Healthcare

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Knowledge management is a growing enterprise. Like all new fields it takes some time to find its place in the world. The goal is to aid action – providing "a knowledge pull" rather than the information overload most of us experience in health care. There are a number of motivations for seeking better knowledge management in healthcare; patient safety, evidence based care and, as a consequence, cost efficiency are the dominant drivers. The most evidence exists for the success of such approaches at knowledge bottlenecks, such as prescribing of medication and clinicians ordering investigations or tests, and for automated reminders and recall based on best practice. Diagnostic and decision support of a more general nature have not yet achieved wide acceptance.

To undertake tasks we need knowledge – knowledge about the task and the relevant (or inferred) knowledge from domain knowledge bases. The challenge in healthcare is to populate such knowledge bases in a generic manner so that they can be used for a number of purposes. The concepts represented must match the concepts in the information sources on which any inferencing is to be based.

For many years health information systems have relied on fixed vocabularies and a specific information system to record details about the health of individuals. The knowledge engineering related only to the use of the vocabulary. The shortcomings of this approach have been recognised by all – large 'silos' of information that cannot be shared with other systems. It is time to strengthen our knowledge modelling to realise greater benefit – whether in process or outcome.

Chong and colleagues have taken on the challenge of taking information from disparate systems and reliably merging the results into a single query result. They achieve this by building knowledge models of each system in a 'metadata repository' and providing mappings of vocabulary and 'context' to enable meaning to be inferred. To do this reliably, context 'lifting rules' (Ackman and Surav, 1996) have to be developed, at least implicitly. The virtually 'federated' information may be reliable if collected in a strict research environment but is unlikely to be in a clinical health record setting – a proposition that could be tested. This does show that knowledge management has a role in the post hoc situation.

Bird and her colleagues describe their experience with 'two level modelling' in creation and querying of electronic health records – an approach that allows separation within the system of the domain (clinical) models from the information model itself. Importantly, the method of representing concepts must be shared by other applications (e.g. the decision support tools) for this approach to be successful. It represents a means of integrating knowledge modelling and systems development to deal with complex concepts that cannot be dealt with by vocabulary alone. This approach may well have applications in other fields.

An important motivation for knowledge management is a 'knowledge bottle neck' and Lewis has addressed the issue of prescribing. This common action in medicine is more complex than many realise and is constantly associated with requests for more information; from drug information on efficacy, dosage, side effects and interactions to the evidence for therapeutic intervention in that particular patient situation. Schrieiber *et al* (2000) are clear that the probability of successful knowledge management interventions is much higher in situations. Lewis has differentiated the human requirement for knowledge and what is computable – something which is of great interest internationally (Peleg *et al*, 2003). Managing the various expressions of the same knowledge is a critical issue for sustainable knowledge bases.

Anyanwu and colleagues have tackled the issue of workflow across clinical domains, something that has traditionally only been achieved with a unified system approach. While the knowledge is an order or two simpler than in prescribing, the possible specified workflows are unlimited and have to be tracked across many systems and geographical locations. The difficulty of specifying the workflow in detail is expressed in the need to generate new code (and applications) to provide suitable interfaces for following the task. Rather than a 'knowledge bottleneck' this approach is more about propagating knowledge or preventing knowledge leakage when many people and locations are involved in providing a health service.

Catarci and colleagues describe visualisation as a tool for interpreting large health datasets such as a lifelong health record or healthcare in a setting where data is collected continually such as renal dialysis. The goal is to allow the rapid and accurate interpretation of the quality of care – for individuals or for groups. The process has the information in the electronic health record (EHR) as its prime input, but depends on knowledge of quality indicators and the human interpretation of visual signals. Knowledge may be best shared by remaking it with new participants, particularly if the context is altered. Strong knowledge models are required for general applicability but the axioms may need to be reassessed in different settings. The visualisation approach does provide another tool for the knowledge engineer faced with representing complex results based on inference rules.

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