

Editorial:

What happens when we have data?

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The current issue of the Journal of Radiation Oncology provides a report [1] that highlights the potential role of routine clinical data in Radiation Oncology and how to make better use of it.

While routine data is not only important to Radiation Oncology but all other areas of medicine also, in Radiation Oncology we have the luxury of two environmental factors. Firstly, we have relatively few software products which are increasingly being driven to the goal of interoperability by the IHE-RO initiative started by Dr Prabhakar Tripereni in the USA[2]. Secondly, there are some well defined standards now implemented, especially the DICOM-RT standard [3-7]. While the planning system vendors may still provide a proprietary file structure, most provide a DICOM-RT export which can be viewed in other planning systems. However much of this work is undertaken by radiation physicists and side steps the realm of clinical medicine.

At present, while I can take a DICOM_RT export from Pinnacle3D and successfully import it into XiO or Eclipse, I cannot export a patient's database entry from an Oncology Information System (OIS) like MOSAIQ and import it into another like ARIA, or the reverse direction. This leads to the tendency for departments to initially suffer proprietary lock-in, and subsequently wholesale loss of data when changing vendors.

How important is Radiation Oncology knowledge? Should Radiation Oncology data structures be a point of competition between proprietary systems? Can a private company claim ownership or copyright over the Radiation Oncology work flow or knowledge structures? Obviously not, as these things predate the companies. So the question then remains, is there a common knowledge structure that we radiation oncologists could reasonably expect would be universally used? That would enable data export for any and all of our patients?

The report by Colonias et al. looks at the high level use of a commercially available OIS within a hospital-based department. The screenshots indicate that a significant amount of data has been collected.

They are to be commended for this, but so what?

We know that our OISs will store our knowledge, but that we have severe difficulties in transforming this into any useful knowledge. In fact the usual paradigm for data is to open, read, digest, QA, translate and transfer to a short-term, separate spreadsheet, analyse and then delete. The errors in the original repository may not be fixed. So the usefulness of the OIS is NOT in its ability to store knowledge. Paper did that admirably.

The measure of an OIS is its ability to allow the stored knowledge to be reconstructed into new knowledge[8]. Unfortunately the OIS is unable to store knowledge. It can only store data, so the knowledge must be de-composed into data. When this is undertaken, relationships we inherently understand as domain experts must be preserved in the decomposition process. Radiation Oncology is a different specialty and therefore will have a specialised knowledge structure and vocabulary [9]. Using a simple example, if I see a red haired patient in a blue shirt, I can store the knowledge as:

"red", "blue", "hair", "shirt"

but then how would I know whether I meant "red haired patient in a blue shirt", or "blue haired patient in a red shirt" (I am tempted to make jokes about hairy people in red/blue shirts too!). I would need to add some structure:

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"hair"
  - "red"
"shirt"
  - "blue"
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Now I know that "blue haired patient in a red shirt" does not fit the knowledge structure.

One would therefore think that the knowledge storage patterns built into the OIS database are consistent with those operating in the heads of radiation oncologists. One would suppose that in a case of bilateral breast cancer where both sides were treated with lumpectomy, the right lumpectomy will be linked to the right breast cancer, and vice versa. Failure to link a lumpectomy to a diagnosis, really means there is no 'why?' for the lumpectomy. The database structure should allow you to ascertain why the lumpectomy was done. If it does, a systematic analysis is possible because it reflects our knowledge structures. If not, analysis may not be useful. Remember that the database knowledge structure (or Entity-Relationship Diagram, ERD) is devised by software programmers, not radiation oncologists. So how can we tell if the knowledge structures are good?

And how is all this data collection useful?

Although there have been some reports of the potential of data reuse[10-12], we are yet to see reports that verify data completeness and consistency, much less reports that suggest we are actually generating knowledge from all this IT activity. Reports, like this one from Colonias et al, that show that a plethora of data can be stored, are useful in informing the oncological community that they may already have the tools.

But more important, and I challenge Colonias et al to next provide us with a follow on report that demonstrates that the data they store routinely is of high quality. The final challenge is the production of reports from this routine clinical data that demonstrates new knowledge applicable to all departments but especially to their department.

The cry for 'evidence-based medicine' is currently aimed at the published literature. The data we hold in our OIS describes how we function and what we achieve. In theory I should be able to compare a published outcome with my departmental data to see if my performance is of acceptable standard. Could it be that this centre has enough data collected to provide local evidence-based guidelines to inform their own medical practice; maybe even to demonstrate that their outcomes are superior to what is reported in the literature?

The challenge for the future, and in particular to Colonias' department is, having demonstrated a superior breadth of clinical knowledge collection, can they move on to demonstrate that the quality of the data is adequate, that is, show that data is collected 100% of the time, and makes sense with related data. And following that can they demonstrate that clinical knowledge generation/learning is possible from the data stored in their system.

If that happens, we are in a brave new world.

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