

Volume 14 - Issue 4, 2014 - Management Matrix

The Enterprise Imaging Repository



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Key Points

- Background and context to the Enterprise Imaging Repository in New South Wales, Australia
- Strategy of eHealth NSW
- Enterprise Imaging Repository goals and objectives
- Implementation challenges and critical success factors
- Benefit realisation
- Next step

NSW's Journey to Pursue Sharing of Image Information across Organization and System Boundaries

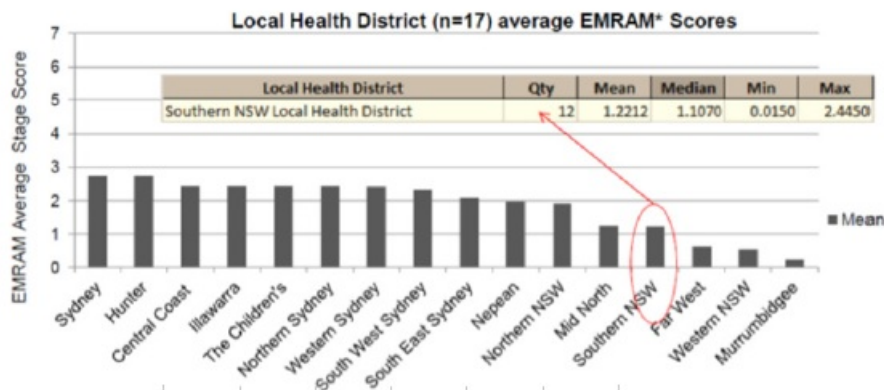
Background

The Australian state of New South Wales (NSW) is the most populous state in Australia. It is situated on the east coast, covering an area of 809,444 square kilometres. NSW has an estimated population of 7.4 million people with just under two-thirds of the state's population (4.6 m) living in the metropolitan areas. Over one-third of the population (2.8 m) is spread out in a fairly large rural and regional geographic area. (see

figure 1)

New South Wales Health (NSWH) oversees 15 Local Health Districts (LHD), one Children's Hospitals Network and a Justice Health Network. These LHDs and Health Networks are responsible for providing health services in a wide range of settings within their boundaries. (see figure 2)

Figure 2



In 2013-14 the NSW Health recurrent expenditure budget was \$17.9 billion, an increase of \$884 million or 5.2% more than the 2012-13 revised budget. This equates to around \$49 million spent across all LHDs and the two Health Networks each and every day. NSW Health employs more than 100,000 staff and has around 2,300 beds across 220 hospitals. In any given day, the health system admits 5,600 patients, responds to 6,500 cases in emergency departments, and carries out 1,000 operations.

Strategic Drivers

Like most countries with an ageing population, there are increasing demands on public health resource as hospital activities continue to increase at a rampant pace. As a result, the pressure for a more efficient health system is greater now than ever before. eHealth NSW's Medical Imaging Program is part of a wider investment in the overall e-health strategy, as NSW Health embarks on its journey to the seven stages of the Healthcare Information and Management Systems Society (HiMSS) maturity model (HiMSS Analytics). Its aim is to improve patient outcomes by providing critical key infrastructure as a cornerstone for integrated care for patients in both metropolitan cities as well as rural and regional areas (see figure 3).

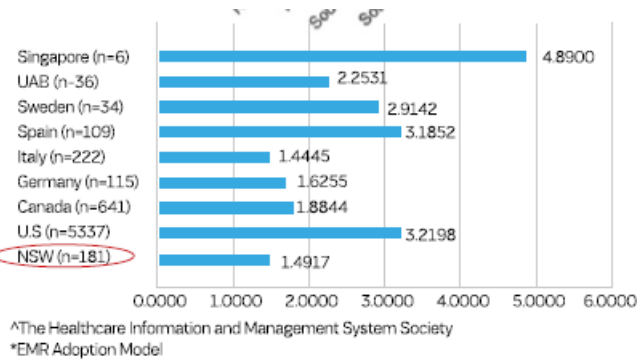


Figure 3

NEW SOUTH WALES RURAL AND REGIONAL LOCAL HEALTH DISTRICTS



NEW SOUTH WALES METROPOLITAN LOCAL HEALTH DISTRICTS



Figure 1



Goals and Objectives

As part of eHealth NSW's Medical Imaging Program, the Enterprise Imaging Repository (EIR) is a centralised store that allows digital radiology images and reports to be shared across public hospitals in NSW. The EIR is made possible by utilising existing medical imaging infrastructure as part of a state-wide Picture Archiving and Communications System (PACS) and Radiology Information System (RIS) implemented by the Medical Imaging Program.

Based on a state-wide federated model, the EIR connects to 10 different RIS PACS supplied by four different vendors, utilising a combination of HL7 and DICOM standards. At the heart of the EIR is the Imaging Repository, utilising a Vendor-Neutral Archive solution and an Enterprise Patient Registry (EPR), based on a proprietary healthcare master person index solution, responsible for reconciling different patient identities across different jurisdictions. Implementation of the solution was overseen by a global ICT solution provider as the primary contractor.

The overall solution is connected to the National Medicare Health Identifier (HI) service, where EPR searches and retrieves the Individual Health Identifier (IHI), a unique patient identifier across the whole of Australia. IHI is an enabler for a broader national e-health strategy in a comprehensive patient electronic health record, known as Personally Controlled Electronic Health Record (PCEHR). (see figure 4)

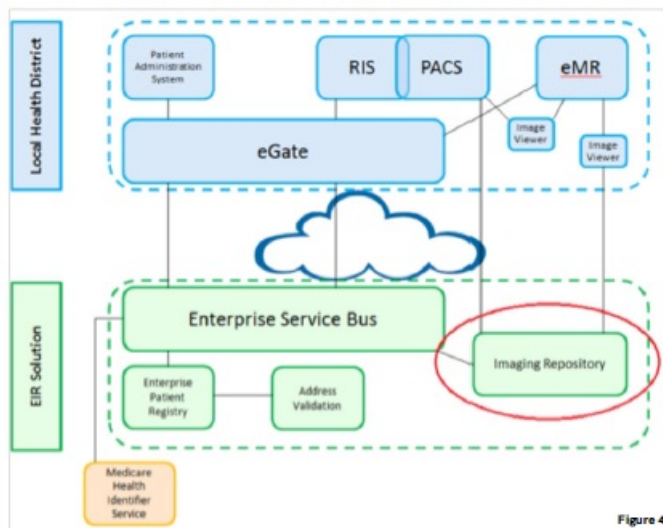


Figure 4

NSW is currently producing around 4 million studies per annum across all public hospitals, around two-thirds of which are generated within metropolitan cities. One of the key challenges that faces NSW are the vast regional areas, which account for the remaining one-third of all state-wide diagnostic imaging. Patient transfers and referrals to tertiary hospitals are common occurrences, as many specialty services are located in the metropolitan cities.

By allowing images and reports stored in the EIR to be accessed by clinicians via a patient's Electronic Medical Record (eMR) or via the hospital's RIS/PACS, not only does it allow clinicians the ability to obtain a more comprehensive picture of the patient's condition and medical history, clinicians are also empowered to make faster and more accurate diagnostic decisions and treatment plans, leading to better patient outcomes. Between January and June 2014, there were approximately 600,000 eMR links posted across NSW. Dr. Allan Kerrigna, a paediatrician at the Orange Base Hospital in rural Western New South Wales, commented that "Being able to share an image with another clinician and discuss and evaluate the same image at the same time adds a new level of collaborative care that we are all working in the same direction. In some instances, it avoids the need to transfer patients to tertiary centres."

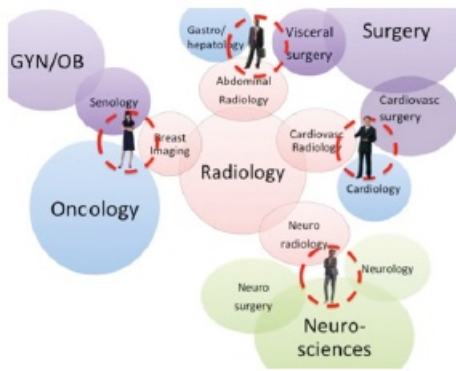
Implementation Challenges and Critical Success Factors

Like many ambitious large-scale health ICT projects, there were a number of challenging factors influencing the success of the EIR project. Not least was the size and the complexity of the integration. Although there are other large-scale VNA implementations around the world, none of these involve multiple instances of health information systems linking patient demographics and radiological information. The EIR solution integrates four different RIS/PACS products, two different PAS and eMR vendors across 16 different LHDs and health networks. In addition, there are over 10 different interface engines, each involving multiple interfaces in and out of the solution. One of the great challenges is the standardisation of different code domains into a statewide common data model; the exercise involved mapping hundreds of codes (and in some instances thousands of codes) across the state, in order to provide a foundation for interoperability between systems.

Another key challenge that the project needed to overcome was to ensure interoperability of the solution across all connecting systems. Even though the solution is governed by industry standards such as HL7 and DICOM protocol, each vendor and indeed each system had a slightly different interpretation of the standards. Initially, the project anticipated a degree of "cookie cutter" approach for sites with similar systems, business processes and clinical workflow. This was certainly not the case as the project progressed through the pilot stage and to the general deployment stage. This not only made the integration effort more difficult, but it also meant that at times changes to the architecture design were warranted. For example, initially the solution was designed to distribute radiology results in the form of a DICOM Structure Report (SR). However, during system integration testing, it became apparent that although DICOM SRs could be received by destination PACS, the content could not be displayed to end users. As a result, changes were made to the solution design in order to utilise HL7 result messages so they are viewable by clinicians in their systems. It is therefore incredibly important to ensure each vendor partner has the flexibility required to accommodate changes as the project matures in its system development lifecycle.

Lastly, efforts to manage both change and clinical engagement within local radiology departments were greater than originally anticipated. With the introduction of the state-wide repository, the LHDs had to work more closely with each other than before, in order to ensure accessibility of the clinical information. For example, the QA workflow now plays a more important role, as incorrect data stored to the EIR could potentially be accessed by clinicians, affecting patient care outcome. With the implementation of the state-wide repository, it introduces an opportunity for standardisation across NSW in terms of administrative processes, such as merging and unmerging radiology studies and the statewide catalogue of radiology procedures and body parts. eHealth NSW continues to work with local PACS administrators to improve existing processes across the LHDs as the EIR solution matures, whilst maintaining a level of local flexibility to cater for specific clinical workflow.

Given that the EIR introduces a level of operational overhead, the LHDs initially raised questions about operating expenses. As part of the stakeholder engagement, the Medical Imaging Program was able to articulate a number of tangible benefits that could translate to potential cost savings for the LHDs, such as performing fewer repeated imaging requests and unnecessary hospital transfers, as well as a reduced local PACS archive footprint. Operating expenses are based on the number of full-time equivalent clinical employees working in each LHD; therefore, LHDs such as those in the metropolitan cities with larger hospitals pay a larger share of total operational expenses for the EIR.



Benefit Realisation

One of the direct outcomes of allowing instant access to imaging information is the reduction of costly and time-consuming repeat tests. This also reduces radiation to patients, who would otherwise require extra imaging procedures. As the EIR project was only recently implemented, ongoing measurement and benchmarking of the associated benefits are to be reported by the LHDs.

Given that the benefits associated with the EIR project are largely clinical, it is difficult to translate into monetary terms without looking at trends and statistics after the period of normalisation post-EIR implementation.

By enabling the seamless transfer of clinical information between systems and health district boundaries, there is an opportunity to close the gap in the quality of patient care between rural and metropolitan facilities by having access to the same clinical specialists, frequently located in the larger metropolitan facilities, for the one-third of NSW patients in rural and regional areas.

In addition, the EIR also has potential future benefits. It could be utilised by other imaging specialities, such as cardiology, breast screening and endoscopy, to store their clinical data. Given the high costs for storing data and maintaining databases, there is a great deal of value in consolidating data into a single repository.

Having a central repository also paves the way for future improvements in efficiency for radiologists reporting on studies. By making studies available outside current boundaries, the EIR could act as an enabler for cross-district reporting. This would provide cost and efficiency benefits, and could help drive a more innovative way of diagnostic imaging across NSW.

Conclusion

As NSW continues to mature with its e-health investments and initiatives, repositories such as the Enterprise Imaging Repository are critical in providing a comprehensive picture of patients' clinical information. Other clinical contents such as discharge summaries are stored in a separate repository that is in the process of being implemented across the state. With the recent successful upload of the National Health Identifiers into the State Patient Registry, NSW is leading the way as the nation's largest consumer of the Individual Health Identifier (IHI). This establishes a very solid foundation for exchange of patient information across public and private sectors through national e-health strategies such as the

Personally Controlled Electronic Health Record (PCEHR).

Published on : Sat, 8 Nov 2014