CHALLENGES OF TRANSFORMATION ON OUR HEALTHCARE IT JOURNEY

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Early clinical systems

Our IT journey in clinical systems began in the 1980s with the nationwide computerisation programme. A computer centre, equipped with mainframes, was set up to serve all five government hospitals. The earliest systems implemented were the Patient Master Index and the Patient Billing System. Drug allergies and medical alerts, a precursor of the Critical Medical Information System (CMIS), were subsequently incorporated in these systems to alert healthcare workers of this critical information at the point of registration.

With the corporatisation of the five hospitals, starting with National University Hospital (NUH) (Kent Ridge Hospital) in the mid 1980s under the Health Corporation of Singapore, the development of ancillary and specialty systems were then brought onto the electronic platform in the then "public" but private limited hospitals. The computer system in the Singapore General Hospital's Department of Pathology, which was the first to be upgraded in 1983, was extended to the other laboratory services such as haematology, microbiology and histopathology in 1991. These formed the first enterprise system in the hospital.

The earliest attempt at electronic documentation started at Tan Tock Seng Hospital's Eye Clinic in 1993. It was selected as their documentation requirements were fairly straightforward for software development within the short period of time.

Subsequent developments into specialty systems were for the accident & emergency (A&E) and pharmacy departments in every hospital in the mid 1990s. They were essentially standalone systems in their own respective areas.

In 1998, NUH initiated an enterprise-level electronic medical record (EMR) system, commencing with laboratory results and radiology reports pulled from the specialty systems into a display engine and referenced to the bespoke admission, discharge and transfer system used for patient administration. This was then scaled to enable outpatient medication orders which flowed into the pharmacy management systems.

The restructuring of acute care hospitals, specialty centres, and primary care polyclinics into two integrated clusters took place in the early 2000s. Both clusters adopted different approaches for their respective EMR systems. One procured a single-instance EMR system that covered the entire cluster; while the other developed different modules in-house based on the Computerised Patient Support System developed at NUH, and linked them together as an enterprise EMR system. Over the years, the two systems matured with the introduction of outpatient

medication orders, followed by computerised physician order entry of laboratory and radiology orders.

This approach was initially chosen over carrying out electronic documentation, as it had greater value from the patient safety point of view, and was easier to achieve as it was possible to ensure operational optimisation as the initial step. It allowed the standardising of processes, introducing of clinical decision support (CDS) and overcoming illegible handwriting.

The EMR systems in both clusters served their intended purposes well, but were essentially independent of each other. It soon became apparent that a significant number of patients were moving across clusters and specialty centres. This inevitably resulted in requests for physical case notes, and the glaring digital gap prompted both IT and clinical specialists to start looking for a solution to address the issue electronically.

The Electronic Medical Record Exchange (EMRX)

By 2004, a system called EMRX, that allowed viewing of hospital inpatient discharge summaries, was built under direction of the Ministry of Health. Within a short time, A&E discharge summaries, radiology reports, laboratory tests results and medications also became available to clinicians from both clusters.

For the first time, this platform permitted the free exchange of medical information between the whole of the public healthcare continuum as the patient transitioned from one healthcare cluster to another. However, only staff of the public healthcare institutions, and subsequently medical officers in the Singapore Armed Forces could use this information, as access was limited by existing information sharing agreements.

Nevertheless, CMIS (commissioned in 2005) was the first national system which allowed bidirectional sharing of drug allergies and alerts into our EMRs. This system greatly improved patient safety and improved the notification of adverse drug events to the Health Sciences Authority.

One patient, one record: the National Electronic Health Record (NEHR)

To move beyond the exchange platform to capture summaries from any patient encounters within the healthcare ecosystem, a concept paper was conceived in 2008. The vision of "One patient, one record" is a single useful overview of a patient's healthcare journey for his entire lifetime. It would include information currently missing from the EMRX system.

NEHR differs from previous EMR systems as it is a repository of visit summaries specific to an individual. While EMR systems contain detailed information of a patient in their respective institutions, NEHR collects key subsets of health information from these multiple healthcare encounters. This information includes all inpatient and A&E discharge summaries, laboratory tests results, radiology reports, details of procedures and operations, as well as medications prescribed. The longitudinal record is designed to facilitate the sharing of clinical information across the continuum of care.

Broad stakeholders were engaged as NEHR was not an IT project but one which involved business and clinical transformation across the sector. Early clinical engagement was established in order to understand informational needs and requirements of both the clinician and the patient.

NEHR went live in 2011, with the successful uploading of healthcare information from the public hospitals, from that year onwards. By the first year, all restructured hospitals, specialist centres and polyclinics, six community hospitals, eight nursing homes, and an increase from an initial 50 to 250 GP clinics had access to NEHR. Adoption of NEHR was initially slow among users with mature cluster-wide EMRs systems, especially when they still had the existing EMRX system. On the other hand, users without such systems found NEHR useful as they did not have to depend on handwritten memos, referral letters or phone calls to verify pertinent clinical information.

Enhancements were subsequently made to improve the user interface and customise care setting views to fit various clinical workflows. NEHR facilitated better integration and transfers from acute hospitals to primary care and vice versa. Its usage grew quickly, and

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as of February this year, about 550 (or 37% of 1,500) private GP clinics have access to it. Direct access to EMRX was eventually removed from one of the clusters' EMR system as they found greater value in NEHR. However, healthcare information prior to 2011 in EMRX was still made available via NEHR.

To give care providers a clear overview of a patient's clinical problems and medications, active medications and problem list reconciliations are in the works. A care and case management system is also being rolled out for case managers, care coordinators and the nursing community to support chronically ill patients with complex care nationally. The overall strategy is to integrate care across care silos and build systems around the patient for better care.

Going forward, NEHR will continue to expand its suite of IT functions and provide information for the integration of patient care services across the healthcare sector. New information elements, in addition to what is already available in NEHR, such as care plans and care team members, are important information for integrating care. These will be incorporated in the Continuity of Care platform – an extension of NEHR.

In our journey from the early stages of clinical systems to the present, there has been increased demand for healthcare professionals to be directly involved in and to lead the care transformation. A new group of healthcare specialists – medical informaticists – who are proficient in both clinical and IT knowledge is required. They can contribute to the design of effective interfaces because they understand clinical uses and processes well. They will enhance the communication between clinicians and IT specialists, in order to ensure new clinical IT systems are user-friendly and effective in improving care delivery. The adoption of health IT systems is not merely an automation of an analogue process, but also involves changes in the way work is done. It can be built to reduce inefficiencies, and provide appropriate clinical information at the point of care. Intelligent CDS systems can be developed to assist clinicians through timely and relevant alerts and notifications. There is a great need for such clinicians to step forward to lead in this transformation.

Challenges ahead

The emphasis on completeness of medical records across the healthcare continuum, patient safety and patient engagement warrants the greater adoption of health IT by clinicians. The maturity of IT systems is an important consideration as we shift from paper to electronic records. The use of clinical applications also needs to be optimised, as our healthcare environment evolves from an institution-specific model to one which is more community- and patient-centric. Over time, health IT should be less of a digitisation of old paper-based processes, but more towards a newer and better workflow emphasising safety, accountability and accuracy.

A large-scale consultation exercise with public and private stakeholders was recently concluded to put together a Health IT Master Plan, or HITMAP, to guide us forward in our IT investments. The key challenge across all applications will be adherence to the basic goal of medical informatics, that is: to develop systems that are usable, cost-effective and of value to patients and healthcare providers.

Conclusion

The transformation of medical practice in the years to come will involve the use of technology, similar to how smartphones radicalise our world today. While mindful of these challenges, we should embrace technology and work towards maximising the potential it has to offer with solutions designed by clinicians for clinicians, and ultimately for patients.

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