15 Health Information Technology and Its Evolution in Australian Hospitals

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Learning Objectives
By the end of this chapter, the learner should be able to:

- Understand basic health information technology definitions and context.
- Understand an approach to developing the project vision and engaging key stakeholders.
- Develop a high-level framework for medical workforce engagement in the planning stages of an EMR implementation through to vendor selection.
- Understand key elements of the vendor selection and procurement process where medical workforce input is required.
- Understanding the importance of benefits and outcomes through the project.
- Understand the phases of an EMR project, key challenges and some lessons learned.
- Establishing clinical governance frameworks and medical workgroups to support the project.
- Appreciate new and emerging information technologies and how they are being applied in healthcare.

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15.1 Introduction

Although many digital information systems exist in healthcare, implementation of an EMR is one of the most significant transformation programs that a hospital health system will undertake, hence a key focus of this chapter. A majority of Australian hospitals today still rely on a mix of digital and paper-based processes. Considerable progress has been made with the implementation of EMRs in hospitals with a number of exemplars achieving international benchmarks of digital capability. This discussion is based on the premise that many healthcare organisations are and will continue to proceed down the path of investing in a substantial enterprise EMR footprint in the foreseeable future. Many of the principles and approaches described are equally applicable to implementation of departmental clinical systems, such as Intensive Care Unit (ICU) and operating theatre management systems. It is recognised that there are many other health information technologies that are important in a hospital and healthcare services such as productivity and collaboration solutions, diagnostic solutions, unified communications, patient engagement platforms, and business intelligence, the coverage of which would take much more than a chapter in a book. The content is designed to arm a medical administrator that has had little experience in health information technology with key concepts for planning and implementing an

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EMR in their organisation. This is supplemented with a case study of St Stephen's Hospital Hervey Bay (St Stephen's) and how Uniting Care Health went about engaging its medical stakeholders and subsequently recognised as Australia's first fully integrated digital hospital.

The last section is a look forward at emerging health information and related technologies to provide perspectives on how these are being leveraged, their potential to impact the way we deliver healthcare and generate thought about preparing the healthcare and technology workforce to take advantage of these to support the delivery of healthcare into the future.

15.2 A Brief Walk Through the Archives of Health Information Technology

In 1971, Dr. Lawrence Weed began to promote the concept of a structured problem-oriented medical record. Around the same time, computational sciences matured in parallel with a renaissance of health information standard development. These have all been necessary foundational elements in pioneering health information systems and have enabled the beginnings of interoperability of clinical information between different EMRs that we have in use today. Two of the most important of these standard initiatives are HL7 and SNOMED. In essence, HL7 group create and curate standards to support interoperability between health information systems whereas SNOMED CT is a clinical terminology that supports the electronic exchange of health data (Table 15.1).

Some of the first commercial health information system vendors were founded in the United States of America (USA) in the late 1970s and leveraged these new standards in their early offerings.

15.2.1 Definitions

E-health is a relatively recent term, entering into the health information technology lexicon in the late 1990s [1] along with other more mainstream "e-" neologisms such as email and e-commerce, reflecting the emergence and disruption enabled by the internet. Despite lacking a standard definition, it would be fair to say "e-health" is taken by many to mean healthcare practice supported by electronic processes and communication [2]. Therefore, the scope of what is encompassed by it is broad—EMRs, mobile health, or mHealth which leverages mobile phones, consumer/patient engagement tools and wearables,

Table 15.1 Examples of health informatics standards developed in the 1970s and still in use today

Standard/ Organisation	Description	Founder
HL7	HL7 (Health Level 7) is a standards organisation and name given to a number of communication standards between clinical system	Dr Donald Simborg, the University of California at San Francisco in the 1970s co-founded HL7
	HL7 2.X messaging standards remain the current mainstay of health information messaging interoperability (e.g. between a 3rd party pathology system to an EMR for electronic diagnostic requests and results)	
	HL7 Clinical Document Architecture (CDA) is a way of exchanging clinical documents between different EMRs	
	HL7's FHIR (Fast Healthcare Interoperability Resources) is the most recent standard to provide a framework of interoperability using standard application programming interfaces (APIs)	Grahame Grieve is the creator and Product Director of FHIR for HL7. Originally from New Zealand, he now lives in Melbourne
SNOMED CT	SNOMED CT (Systematised Nomenclature of Medicine—Clinical Terms) is the most widely used clinical terminology	Dr. Roger Cote led the development of SNOMED in the mid-1970s
	SNOMED CT has been adapted to different countries, and in Australia, it is labelled as SNOMED CT-AU. It is the preferred clinical terminology in Australia	

telehealth and personalised health to name a few. Digital health, a synonymous term with e-Health, is also being used increasingly in the health information technology vernacular.

The terms EMR and EHR are often used interchangeably, and refer to an electronic record of care. However, EMR has been in existence longer and has traditionally been used to encompass an electronic record of care within the four walls of a healthcare delivery organisation. EHR implies a longitudinal record of care that aggregates patient care information across multiple organisations, a good example being the national My Health Record initiative in Australia.

15.3 Where Are We Today?

One may think that the discovery of a medical record on papyrus over 4000 years ago would place healthcare well ahead of the curve in adopting digital technology. However, compared to other industries, digitisation of healthcare has been relatively slow, due to a range of challenges. Healthcare is by its nature very complex; overlay this with a complex regulatory environment, relative underinvestment in health information technology and robust, implementable health technology standards being developed relatively late, it is understandable why progress has been slow.

There are some exceptions, one of the most notable being the adoption of practice management systems in General Practice. As early as 2006, a large survey of General Practitioners (GP) in Australia found that more than 90% used an electronic health record [3]. They reported that electronic prescribing alone had contributed to improved efficiency, quality of care, and reduced medication errors. In hospital environments, clinical information systems and EMR implementations are progressing in many parts of Australia, and funding for this is being increasingly viewed as a strategic investment. Clinician attitudes have evolved, being driven in part by the place of technology in our daily lives, and an increasing confidence in clinical information systems and EMRs adding value to the jobs they and their health services do.

Related digital health technologies continue to improve apace, with the ability to stream and analyse data from medical devices, such as bedside monitors. Smart pumps and automated dispensing cabinets can be connected to EMRs to enable closed-loop medication processes. As the amount of clinical data dramatically increases, other technologies such as cloud services are increasingly being leveraged. These platforms offer scalable and high performing computers that can help with aggregating data from multiple sources, handle complex analytics such as developing risk models for unplanned readmission risk and early warning of clinical deterioration as well as the ability to connect this information back to clinical systems and mobile applications.

More hospitals globally are becoming digital and have wanted to benchmark their EMR maturity. HIMSS is the Healthcare Information and Management Systems Society—a not-for-profit organisation focused on optimising better health through the use of information technology. The benchmark model they have developed is "EMRAM" (Electronic Medical Record Adoption Model), which has become the industry default. The EMRAM model is divided into eight stages (0–7) with stage 7 being the most mature and indicating a full EMR, with standards-based interoperability and data warehousing as detailed in Fig. 15.1 below. Note that different geographic regions have slightly different EMRAM models.

Although the model does not necessarily correlate to a set of clinical or operational capabilities that are easily understood by clinical and operational audiences, it does offer an opportunity to compare progress in health information technology maturity within Australian hospitals and to be able to benchmark this with other countries.

Around 75% of the 271 Australian hospitals surveyed and reported in 2015 were at HIMSS stage 2 [4]. Since late 2014, three Australian hospitals have achieved HIMSS EMRAM stage 6, namely St Stephens Hervey Bay and Princess Alexandra Hospital, Queensland and the Royal Children's Hospital, Victoria. The US Government's Meaningful Use initiative, through financial incentives and more recently penalties for the implementation of certified EMRs, has been the main impetus of EMR implementations

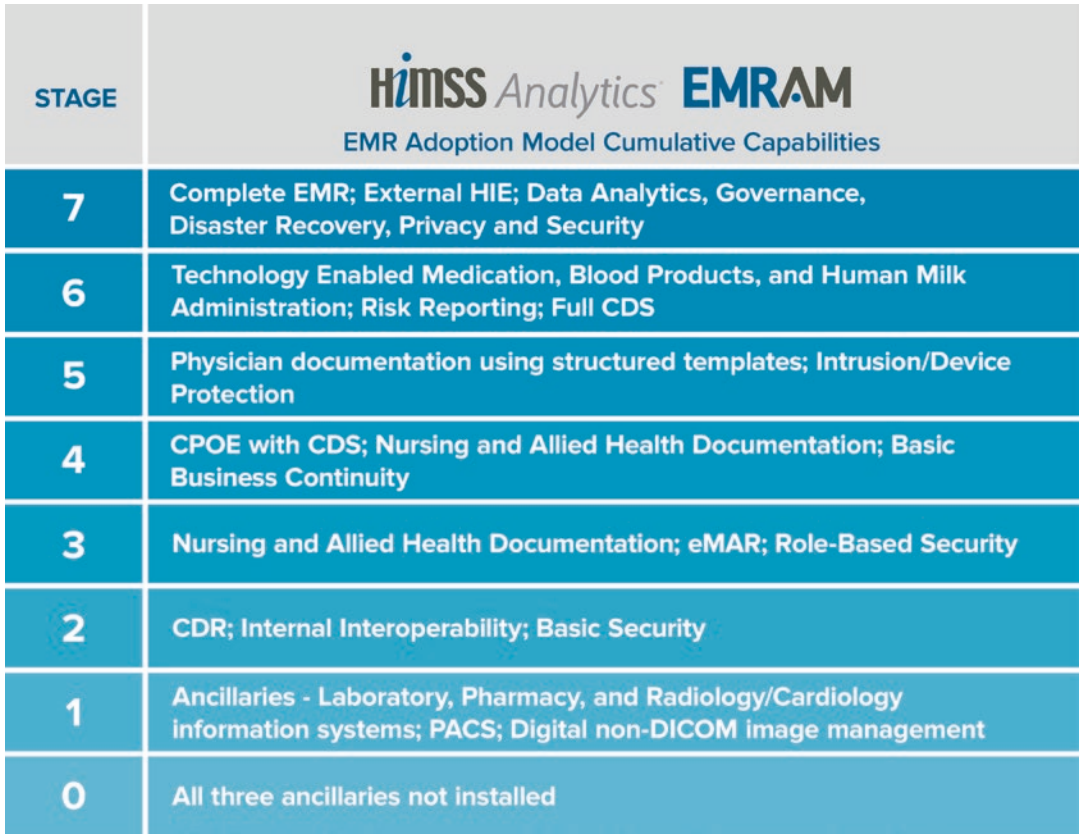

Fig. 15.1 HIMSS Analytics' EMRAM. (From HIMSS Analytics Asia Pacific. HIMSS Analytics® Database ©2012. www.himssanalytics.org/asia-pacific/home with permission)

across the country; as a result of this, 38.8% of 5480 US hospitals surveyed in 2017 had achieved HIMSS EMRAM Stage 6 or 7.

15.4 Drivers for Health Information Technology-Enabled Change

It is worth beginning this section with a few historical anecdotes to understand how the pace of intergenerational technology change is accelerating and how health information technology has evolved within this context.

It was 1973 when Motorola demonstrated the first commercially available mobile phone, with 30-min talk time and weighing in at 1.1 kg. The subsequent arrival of digital cellular networks in the 1990s captured the mass consumer market globally with over 6 billion active mobile phones in service in 2014 and a projected 2.3 billion active smartphones in 2017. Tim Berners-Lee proposed a networked information system using hypertext pointers to locations across an internet in 1989, which later became what we now know as the World Wide Web. It was as relatively recent as April 2010 when the first tablet, the iPad, was released by Apple for pre-order purchase, for which there was rampant adoption by the medical community.

These enabling and ubiquitous technologies with ever-increasing power, speed, connectivity and convenient physical form factors have changed many aspects of the way we conduct our everyday lives, and have opened the door with new possibilities in how we interact with ser-

vices. The rapid adoption of disruptive technologies continues and shows no sign of slowing. The recent proliferation of health and medical wearable devices, the looming emergence of 5th generation wireless broadband (5G) mobile connectivity enabling potential speeds of more than 100 Mbps in metropolitan areas, will further shape our interactions, consumption and use of health data into the future.

At the core of most health IT-enabled programs of change, whether it be at a national, regional or local health organisation level, is the drive to improve the quality and efficiency of care to patients and populations [5]. The Australian Safety and Quality Framework for Health Care [6] describes a vision for safe and high-quality care for all Australians. It specifies three core principles for safe and high-quality care. The first one is that it must be consumer centred, driven by information, and organised for safety. The tenants of the Quadruple Aim, which overlays the importance of care for providers on top of the Triple Aim, can all be positively impacted by the use of information technologies.

There is an accumulating corpus of literature on outcomes enabled by implementations of health information technology including EMR. A recent paper from the Australian Healthcare and Hospitals Association assesses much of the recent literature on outcomes resulting from many types of health IT initiatives [7]. As most would agree, there is still work to be done in evaluating outcomes. It is, however, a complex analysis given the diversity of technology, scope and health services undergoing an implementation program. It is also a focus that is often de-prioritised as so much of an organisation's energy goes into "going live" rather than the impact analysis after. One of the most active researchers in this space in Australia is Professor Johanna Westbrook, from the Centre for Health Systems and Safety Research, Macquarie University, Sydney. Professor Westbrook's Centre researches the impacts of digital health technology on health service delivery. The Centre has looked at electronic medication management system related outcomes such as reduction in medication errors, cost-effectiveness, and the impacts on clinician time and patient flow using electronic laboratory orders and results to name a few.

Outside academia, a number of healthcare organisations have also measured and publicised outcomes relating to health IT implementations, some of which have been recognised with state and national awards.

Developments such as these are key in highlighting areas of impact and support the case for subsequent health IT investment. There are numerous digital health and related events in the Australian calendar which are a fantastic source for health service and industry presentations on real-world outcomes achieved. A few examples of Australian healthcare organisation outcomes are provided below.

15.4.1 EMR-Enabled Outcome Examples in Australia

15.4.1.1 Academic Research

1. Medication prescribing errors were reduced from 6.25 to 2.12/admission ($p < 0.0001$) in a New South Wales metropolitan hospital following the implementation of an e-prescribing system. Serious errors decreased by 44% ($p = 0.0002$) [8]
2. Implementation of an electronic medication management system in an NSW hospital cardiology ward was associated with an annual reduction of around 80 adverse drug events and related savings of $97,740–$102,000 savings over the year. Extrapolated over the hospital with 39,000 annual admissions, this would equate to savings of $2.5 million/year in health costs [9].
3. A big bang implementation of an integrated EMR at Australia's first digital tertiary hospital, the Princess Alexandra Hospital, Queensland which has over 6500 staff, at the end of 2015 noted an initial drop in ED productivity by 25% that returned to pre-implementation by 6 months [10].

15.4.1.2 Health Service Published Outcomes

1. Austin Health and Peninsula Health implemented EMRs with diagnostic orders and results, medication management, and electronic discharge summaries. They were the winning recipients of the Clinical Excellence and Patient Safety award from The Australian Council on Healthcare Standards in 2013, for their work on showing:
   - A reduction in medication error of 55% across their subacute areas.
   - Better allergy compliance—99.9% completion of allergy status (93.2% within 24 h) and 99.9% accuracy of allergy status compared with 95% completion and 68% accuracy pre-implementation.
   - Timely discharge summaries to GPs—overall electronic discharge summary compliance increased from a median of 68% to 83% completed within 48 h from 2011 to 2013 [11].
2. Liverpool Hospital, Sydney, improved compliance of surveillance for pressure injury with Waterlow documentation and consolidated electronic ordering of pressure surfaces, resulting in reduced hospital acquired point prevalence for pressure injury from 13% to 9% in 12 months (2009–2010), with a further reduction to 8% a year later. Also reduced severity of pressure ulcer grades, 73% superficial ulceration in 2009 compared to 97% superficial ulceration in 2010 (i.e. non-superficial tissue ulceration reduced from 27% to 3%) [12].

For clinicians and others delivering healthcare in frontline services, there are many who now view an EMR as a strategic priority providing timely access to clinical information across a plethora of traditionally disparate and incomplete systems. These digital foundations are critical if we are ever to achieve a comprehensive and harmonised view of the patient across the care continuum as well as population health data to further clinical research and support clinical service delivery.

Clinicians who have gone through their clinical training and junior years using an EMR are placing increasing value on having an EMR as a core tool. Making the transition back to organisations that have limited health IT systems can be challenging as many manual processes are no longer imprinted in their memories, such as the ability to write a physical inpatient medication chart if a clinician has used electronic medication entry with drug interaction clinical decision support, for example.

15.5 Challenges for Health Information Technology-Enabled Change

Healthcare environments are incredibly complex. Layering technology over the top of this complexity in itself will not fix divergent and poor processes. EMR implementations are challenging endeavours due to the breadth and depth of impact on many different stakeholders. The technology and functionality required to meet these demands across the entire hospital system are accordingly complex and one of the reasons why the hospital vendor market has globally consolidated to a smaller number of players.

Globally, investment in IT in healthcare has been low compared to other industries with IT spend per employee being the 3rd lowest of all industries surveyed in a 2012 Gartner IT Key Metrics Data Summary Report [13]. This has changed recently in the USA at least, driven by the Meaningful Use program.

End users experience and expectations of an EMR's interface, and assessment of its simplicity and mobility have been shaped by the interactions they have with everyday technology such as smartphones. Naturally, this is a challenging comparison given an EMR is an enterprise application handling huge complexity and diversity of processes across a health system. While most EMR and clinical software vendors recognise this and are progressing improvements in user interfaces, there is still some way to go to meet these expectations.

In Australia, the fiscal demands on our health services and tremendous recent investment in new hospitals have created a challenging environment for health services to make the case for investment in digital health technology amongst competing priorities. Some states have committed to strategic long-term eHealth programs, whereas others have made more piecemeal investments, often driven by funding constraints, priorities and the desire to prove success and value before rolling out tested solutions. Although there is an increasing number of proof points of successful outcomes in Australia as discussed previously, comprehensive analyses demonstrating a clear Return On Investments (ROI) is a challenging endeavour given the complexity and heterogeneity of an EMR implementation. The front and centre objective of implementing an EMR should be to improve quality, safety and efficiencies of healthcare delivery, with secondary value in financial gains where these are able to be reliably measured. Where cost savings to an organisation and health system are demonstrable, this can drive further investment in other health IT-enabled change projects.

A major detractor in Australia at times has been a very public critique of the previous state and federal health IT programs. Many of these have tended to focus on the weaknesses, challenges, or incomplete delivery of the programs being critiqued, and often a disproportionate lack of focus on program successes.

15.6 The EMR Journey: Preparation

During the interval between the green light to procure an EMR to selection and contracting with vendors, there is a golden opportunity for an organisation to establish vital program building blocks that positions the program well for success. It is also very necessary to consider other change programs that might be occurring across the organisation around the same time. These may include other health information technology system implementations, upgrades, non-IT related transformation programs, or even new capital works programs. These may need to be coordinated at an organisation program level to ensure interdependencies, risks and the overall level and tolerance of change are well understood.

Given the complex nature of EMR implementations, risk needs to be carefully managed along the entire journey. Failures of EMR programs are both well documented and well publicised. "Learn from those that have gone before us" should be one of the doctrines emblazoned on the project room door. Incorporating lessons learned from local, national and international experience will go a long way to help mitigate these risks. Key critical success factors of EMR implementation programs are provided below and while by no means exhaustive, many can be mitigated well before a contract with an EMR vendor is signed.

- Strong and committed senior executive support with the CEO being a champion or sponsor of the program.
- Clinical engagement and ownership of any clinical system implementation—a targeted medical engagement and governance strategy needs to be specifically designed and resourced (including back-fill of staff where needed).
- A clear, concise, and well-articulated vision that has meaning and can be communicated across the organisation.
- Clear goals of the program that are potent and resonate with staff across the organisation strong medical and clinical leadership and governance throughout the course of the program.

15.6.1 The Call for Change, Creating a Vision and a Strategic Approach

John P Kotter's book Leading Change describes a series of eight steps to effect change. The first three encapsulate the need to create a sense of urgency, assemble the right team to drive that change and achieve consensus on the vision. In healthcare organisations in Australia, it has

typically been a senior member of the executive team or a particularly motivated clinician or group of clinicians, which start those intrepid early discussions as to why the organisation should embark on an EMR implementation journey. For publicly funded health delivery organisations, this may be triggered by an opportunity to secure available funds, or to implement clinical systems as part of a statewide implementation program. eHealth New South Wales and Queensland Health are examples of such initiatives.

Being clear on the vision for implementing an EMR is essential in the early days of a project, to align those championing its cause, and to develop a strategic approach to the program as it evolves. The vision should be more than a marketing sound bite. It needs to be honest, concise, believable and achievable, and perhaps most importantly, able to address the health IT mantra of "what is the problem we are trying to solve?" Making a vision patient centred will no doubt resonate across the organisation and should be established as a principle through the project. Having senior executives (including the Chief Executive Officer) and key stakeholders contribute to the vision from the start drives sponsorship and endorsement of the importance of the program to succeed.

Facilitated sessions of stakeholders from across the organisation help in determining the goals that support the vision. It is worthwhile establishing an early stakeholder engagement exercise. Meeting with representatives from the executive and impacted clinical services, ensuring there is balanced representation from medical, nursing, allied health, administrative, operational will help the project team to really understand:

- Challenges with current information systems.
- Competing priorities or projects of their clinical service.
- Priorities and expectations of a future clinical information system at go-live, in 3 years, in 5 years.
- Improvement opportunities post-imple mentation, such as service quality, safety, cost reduction, and efficiency.
- The goals of the EMR program must be evaluated against the organisations own planning and strategic goals and aligned where able.

15.6.2 Establishing Critical Roles: The CMIO or CCIO

The rollout of digital health and EMR projects requires a substantial investment. Strong leadership is needed from the executive and strong clinical leads are critical to delivering success. New posts such as Chief Medical Information Officers (CMIO), Chief Clinical Information Officers (CCIO), and Chief Nursing Information Officers (CNIO) have emerged. One of the core responsibilities is to design and deliver clinical engagement and governance, both of which are fundamental to the success of these programs. This section focuses on medical leadership positions, acknowledging the vital role that is played by other professional group colleagues. Success relies on a leader that is respected by peers, comfortable with change, tenacious and a conviction in health information technology being an agent to positively impact care delivery. The skill mix for a CMIO is a unique one. They require knowledge of the contemporary healthcare environment, demonstrated ability to effect change, knowledge of current and emerging healthcare information technology drivers and capabilities.

The CMIO has the unique role of being a translator between the clinical world and the IT world—two worlds with different languages and cultures, while also representing the needs, and objectives of the organisation. A program of this size is clearly a team sport and one of the key functions of the role is to empower colleagues in designing key elements of the system (defining new workflows, configuration of clinical content, etc.) and ensuring appropriate accountability along the way.

In a 2006 research paper written by Leviss et al. studying the role of the CMIO in the USA, Leviss

reports that "*individuals indicate that executive leadership skills are more valuable to a CMIO than formally trained informatics expertise—for all but one CMIO, leadership experience and training strongly outweighed formal informatics training*" [14]. Adding further that "*The CMIOs surveyed have leveraged their leadership and informatics expertise to effect broad health system change and to accomplish health system goals, rather than relying solely on technical backgrounds to build information systems. Recruiting and empowering effective CMIOs will enable a health system to best meet the challenging tasks of technology-enabled transformation*". This should be no different in the current Australian environment where the complex task of leading healthcare transformation by eHealth requires an expert in healthcare change management versus an expert in information technology.

Governance and reporting lines vary across the world; the majority reporting to Chief Information Officers or Chief Medical Officers, fewer reporting to CEOs and Chief Operating Officers (COO). Success relies on the CMIO sitting at the Executive table and leading the development of the digital health strategy. The CMIO needs to work as part of a multidisciplinary team with a group of technical experts and clinical informatics experts and program management experts.

This group is a relatively new breed in Australia, with an increasing number of formal roles now in post within health organisations, States and Territories and nationally. The first CMIO appointed was in August 2012. Dr. Monica Trujillo is a FRACMA passionate about health improvement through IT and was an integral part of the project team for St Stephens Hervey Bay, Australia's first fully integrated digital hospital and the first to obtain HIMSS EMRAM level 6. These new roles are vital and should be supported beyond the implementations of an EMR. Post-implementation there will be ongoing medical expertise required to ensure systems are optimised, contribute to digital health strategies and ensure the clinical related goals of the project are met. It is often quoted that "an EMR is never done" and with the rise in modern technology, that is even truer today and lends more weight to the importance of clinicians persisting in these important roles.

15.6.3 Establishing Early Clinical Governance

The United Nations has a particularly concise and useful definition of governance as the process of decision-making and the process by which decisions are implemented. It is important to design an engagement and governance strategy early in project planning, even during procurement.

If there is already a clinical governance structure in place that has responsibility for clinical information system implementation, it makes sense to consider leaving this intact provided it has adequate representation, support and clear accountabilities in line with the EMR program.

If existing clinical governance arrangements are inadequate, new governance entities can be created. It is worth establishing a Clinical Advisory Group (CAG) focused on the EMR procurement, which represents the clinical community most affected by the project with medical, nursing and allied health professional representation and chaired by the CMIO or CCIO or another clinical sponsor.

The governance arrangements for the CAG must be clear as to the responsibilities, accountability, membership and escalation process if decisions are unable to be made by this group, as well as escalated decisions requiring resolution by this group.

The responsibilities of the CAG should include support and decision-making on scope, phasing, and opportunities for value and outcomes and benefits, as well as input and review of business cases. Participation of the CAG members in vendor selection is vital to engender a sense of ownership and buy-in from this key clinical stakeholder group. Consideration should be given to the Clinical Advisory Group evolving to form the nucleus of a Clinical Steering Committee when the project kicks off.

15.7 Determining Initial Scope and Phasing

Scoping a project is a challenging but important function for the project team responsible for the EMR journey. This is necessary in order to message across the organisation the types of capabilities the EMR project is likely to deliver and not deliver. It serves to clarify what is out of scope, what are the agreed priorities and it is an input into early planning such as indicative project costs and resourcing need estimates. Inputs into an initial scope for an organisation can be from:

- Organisational strategic priorities
- Organisation digital health strategies
- Discussion with other similar organisations that have implemented an EMR
- Priorities from the early stakeholder engagement exercise discussed above
- Dependencies on other legacy systems, such as a 3rd party pathology system and a patient administration system
- Indicative infrastructure requirements, for example, a wireless upgrade
- Indicative hardware requirements, for example, new PC workstations, mobile devices

At this stage, it should not be expected that the scope of a project will be completely locked down, given the procurement and contracting discussions that will follow with the selected vendors. Outputs from the above can be considered against a capability framework, a sample of which is provided in Table 15.2.

There will also be a host of technical requirements such as hosting, cybersecurity, and identity management, implementation requirements such as project methodologies and training, and service requirements for support post-implementation. Although EMR programs in themselves are significant undertakings, there may well be other health IT and technology projects to consider:

- Bring Your Own Device (BYOD) policy
- Unified communications solutions and services
- Integration with legacy in-organisation systems, state systems, and national systems

In addition to scope, a view on the phasing of the program of work should be formulated. The debate of a "big bang" approach versus a phased approach has not yet been resolved once and for all and probably never will. "Big bang" refers to a significant amount of a complete EMR implemented in one go live. A phased approach implements in tranches to particular clinical services, for example, an Emergency Department or perioperative service, or phases core EMR functions such as diagnostic orders and result reporting first, medication management second and full clinical documentation last. What is clear is that whether it is a big bang or phased approach, the best approach will be the one that best fits the organisational needs at the time. Big bang approaches have been used across large and complex healthcare organisations in the USA. For example, Banner Healthcare, a not-for-profit 28 hospital system across 7 states, with 39,000 employees, and now HIMSS stage 7, initially implemented an EMR in one facility and then rolled it out to the remaining 27 over 4–5 years.

Historically, phased approaches have been used in Australia, often due to the level of program funding and therefore resource constraints with the separate phases. However, the big bang implementations at the three hospitals that have obtained HIMSS stage 6 (Royal Children's, Princess Alexandra and St Stephen's Hervey Bay) have all had very successful go-lives.

Making a concrete recommendation on which approach to take must take into consideration numerous variables. Advice can and should be sought from other health services who have implemented an EMR. Potential vendor partners are great sources of information and can offer recommendations on resourcing, interdependencies with different EMR capabilities and how to phase different clinical services during the go live. Table 15.3 lists some of the key pros and cons of each approach.

15.7.1 Preparing a Successful Business Case

Key ingredients of a robust business case are value and outcomes, or benefits expected as a result of the implementation. Examples of

Table 15.2 Electronic Medical Record high-level capability framework example

EMR/clinical system	
Capability group	*Function/process requiring support*
Core clinical capabilities - Patient lists	Patient lists, e.g. ward lists, custom lists Clinical dashboards/journeys
Core clinical capabilities—EMR	Documentation • Assessments and structured documentation • Patient observations • Narrative in-care setting notes (e.g. admission, progress) • Continuity of care (transfer, discharge letters) Orders • Diagnostic (laboratory, imaging, other), nursing and patient care • Order sets and care plans Results • Results access and display • Results acknowledgement Medication management • Allergies and adverse drug events • Prescribing, verifying and administering Clinical decision support rules
Core clinical process	Managing and storing patient consents Supporting clinical handover Blood product management Managing internal consults/referrals
Clinical service-specific capabilities (additional or specific capabilities not covered in core)	ED (e.g. ED tracking board, pre-arrival) Perioperative (e.g. theatres tracking board, anaesthesia documentation) ICU (e.g. electronic observation chart, bedside monitor interfaces) Women's Health (e.g. integrated CTG) Paediatrics (e.g. paediatric medication order sentences) NICU (e.g. bilirubin nomogram) Cardiology (e.g. integrated ECGs, cath lab documentation) Renal (e.g. dialysis machine integration, CKD management) Oncology (oncology trials, oncology protocols) etc.
Other	
Capability group	*Function/process requiring support*
Clinical trials and research	Trial enrolment and management
Reporting and analytics	Real-time dashboards Operational reporting (standards reports) Enterprise reporting (ad hoc, etc.)
Core administrative services	Master patient index Referral and waitlist management Enterprise scheduling
Patient engagement	Patient portal Patient education and wellness Virtual health
Medical device integration	Anaesthetic machines Bedside and portable monitors Automated dispensing cabinets, syringe drivers, IV pumps Dialysis machines, etc.

EMR outcomes from health services in Australia and abroad, some of which are described previously in this chapter, can be used to model target outcome as part of the EMR program. Some vendors and many advisory companies will offer support with providing evidence and supporting documentation for this. Outcomes can be summarised and grouped under headings such as:

- Bankable Savings, for example, a reduction in scanning and stationery costs
- Quality and safety, for example, a reduction in pressure injury, reduction in sepsis mortality
- Efficiency, for example, the number of bed days saved from decreased Length of Stay (LOS)

Outcome targets can be used to tailor communication messages to the various stakeholder

Table 15.3 Considerations of big bang versus phased approach to implementation

Approach	Advantages	Disadvantages
Big bang	Speed to value	Increased resource requirements initially
	Compressed timelines (for comparable capabilities)	Increased training requirements
	Resource efficiencies (e.g. training mostly in one hit, no recurrent implementation project teams)	Greater level of change at once and potential for greater productivity loss initially
	Workflow more streamlined (e.g. no need to manage transitions between EMR-enabled clinical services vs. paper-based ones as all electronic)	Greater testing effort required at once
Phased	Greater tolerance of smaller projects	Delay in realising value and outcomes from implementation
	Less testing effort and more capacity to address testing issues	Change fatigue from end users
		Process fragmentation due to incomplete workflows
		Potentially more expensive over the long term (e.g. recurrent project costs)

audiences, such as clinical, financial, and executive. Each target should be appropriately assigned to a key sponsor. Progress against these targets during the EMR project and after go-live is important to ensure the success is measurable.

15.7.2 Procurement Approaches

The procurement processes for healthcare information technology vary significantly across different organisations in line with policy. Government organisations need to follow the procurement policy while other organisations will have a local policy. The formal process that public organisations generally use is a Request for Tender (RFT) or Proposal (RFP) process which is sometimes preceded by an Expression of Interest (EOI) or Request for Information (RFI). The intent of the EOI or RFI process is to canvass vendor interest, horizon scan and to inform a subsequent RFT or RFP process.

For health services that wish to evaluate the impacts, opportunities and risks of a project more fully before they commit to proceeding, an Implementation Planning Study (IPS) is increasingly being used for business assurance. This is usually done by the organisation or by the preferred vendor. This process itself can be costly both financially and in time, however.

EMR implementations are inherently complex. Consequently, RFT/RFP and EOI documents are usually complex. There are significant challenges in the process, namely the duration, effort and cost for all parties involved. Many RFT or RFP include hundreds to thousands of functional and technical requirements, the value of which must be considered versus the effort and reliability of the requirements. Considerations of a requirements heavy tender process are provided below.

- The requirements themselves are often subjective, may not reflect true end-user requirements and are open to interpretation. The vendor's interpretation and response may be completely different resulting in obvious potential consequences for both.
- There will always be temptation for vendors to inflate compliance against the requirements in order to get through to the next round.
- It becomes a very onerous process to evaluate the raft of multiple vendor responses for the health organisation.
- Elaborate requirement-based documents tend to have minimal value during the implementation phase.

Organisations should look to leverage and share tender development work done by similar organisations and for similar programs. Alternative and agiler contracting approaches should also be considered. Issuing an EOI followed by a detailed engagement with a select number of vendors through a closed process helps managing responses from the entire market. Vendor selection will usually follow multiple steps in this process, for example:

- Vendor response to tender schedules describing functional requirements and system infrastructure
- Health service evaluation of vendor responses and other required evaluations, such as reference site calls to other health services that have implemented the vendor's solutions
- Short listing of Vendors for demonstration and evaluation
- Demonstration and tender clarification rounds
- Pricing and best and final offers
- Final selection of Vendor
- Board endorsement or approval of Vendor
- Contracting
- Board endorsement or final approval of program

15.7.3 Vendor Evaluation and Selection

The analogy of a marriage between the EMR provider and the health service has been used by many that work in the industry. This metaphor embraces the concept of partnership which is at the core of successful EMR projects. Partnership implies a way of working together, problem-solving and jointly celebrating success. Formalised partnership models can include risk sharing of the benefits and outcomes realisation, implementation collaboration models, for example, where vendor staff are co-located within the health services or vice versa, and sharing of intellectual property for new software innovation, or content development agreed as part of the program.

An evaluation framework needs to be established in readiness for the tendering process. There are multiple dimensions against which vendors need to be assessed and a sample of these are provided in Table 15.4.

Evaluation of the vendor clinical solution capabilities needs to be led primarily by clinicians, given the obvious clinical impact of an EMR, and to ensure a sense of ownership when the project kicks off. Any visits to reference sites, attendance at demonstrations and other related activities must have appropriate levels of clinical involvement to ensure clinicians buy-in and to leverage their expertise in the vendor selection.

Table 15.4 Vendor evaluation framework

Evaluation topic	Evaluation details
References	Evaluation of local and international reference sites provided by the vendor (for similar health services, exemplars of the solutions being scoped)
Implementation capability	Evaluation of implementations to local and international health services:
	• For similar health services
	• For similar solution scope
	Evaluation of vendor client health services on a particular HIMSS level
Solution capability	Evaluation of functional responses, demonstration, solution gallery
Technical capability	Evaluation of technical responses (e.g. technical architecture, system reliability, hosting models, interface capabilities, device integration)
Local capability	Evaluation of company presence (duration, office locations, EFTs, etc.), details of implementations (with utilisation)
Product strategy and innovation	Evaluation of product development (e.g. strategic roadmaps, industry partnerships), research and development (R&D budgets, first to market innovations), industry awards
Implementation approach	Evaluation of implementation methodology (e.g. project management framework, project tools, risk management, training, go-live support)
Support models	Evaluation of the options for support post implementation of the solution (e.g. help desk, application managed services)
Pricing	Evaluation of pricing with clear guidance on inclusions and exclusions

15.7.4 Best of Breed Versus Integrated Solution Considerations

Often a clinical service will push for a particular best of breed system for their service. This approach is understandable as these systems are tailored for that particular clinical service and do not carry the costs and complexity of an integrated EMR program. There are some very important considerations to make in this approach, some examples of which are listed in Table 15.5.

Table 15.5 Integrated vs. best of breed solutions considerations

Area	An integrated solution
Usability	May not always be as finely tuned to the needs of a particular clinical service as some best of breed systems
Workflow	Is much more likely to support workflows across clinical services due to patient-centred record (rather than clinical service centred record) so information will flow across clinical services. This is particularly true when electronic medications management (EMM) are implemented. For example, managing medication allergies in multiple systems is challenging and risky, as is managing patient transitions between parts of the hospital that are using EMM and those that are not.
Documentation	Can re-use data held at the patient level so the need to double document between different clinical services is reduced
Clinical decision support	Provides a more cohesive strategy to rules-based clinical decision support with one rules engine running on the same data
Reporting and analytics	Is much less likely to require data extraction from multiple sources
Interfaces	Requires significantly fewer interfaces (which are costly to develop and maintain)
Support	Potential for more efficient support model (e.g. tools, code sets are common across the platform
Development	Maybe less responsive to product change requests. Best of breed suppliers are smaller, less complex and may be in a better position to turn changes around faster

15.7.5 Vendor Contracting

Once the decision to proceed with a particular vendor is given, contracting processes will begin, involving legal counsel and contract. There are a number of law firms that have built up considerable expertise in this area. Contracting is often viewed by the respective parties as a combative process with each party naturally seeking the optimal contractual outcome for themselves. This can lead to adversarial approaches that reduce the opportunity to partner.

A far more effective contacting process starts with the premise that in order for the project to succeed, both parties must support each other's mutual success as much as their own. Only when this occurs does a truly aligned approach and aligned success prevail. If the contract can capture the nature of a true partnership and the term is not just a platitude, the opportunities for mutual success dramatically increase.

15.8 The EMR Journey: Before Go-Live

The interval between contract completion and go-live encompasses the major share of the work. The duration of this phase is based on many variables such as scope and resourcing, but most healthcare organisations will allow between 12 months and 24 months to design, build, test and go live with the system. Some of the critical success factors during this phase are:

- Clinical ownership of any clinical system implementation
- A thorough and well thought out implementation plan
- Realistic and communicated limitations on scope and priorities
- Strong stakeholder and communications strategies
- Robust clinical governance
- Strong program management expertise
- Sufficient numbers of skilled resources including backfill for organisational subject matter experts (SME)

The importance of communication to all of those impacted by the project cannot be understated and are key to creating awareness, interest and excitement. Some organisations invest significantly in their communications and have used creative strategies such as covering all the lift doors with content promoting the project.

15.8.1 Implementation Governance Considerations

Designing good governance for an organisation EMR project is a skill and there is no one size fits all. It is critical that this is as robust, inclusive and productive as possible.

The typical four interdependent components of governance related to an EMR project are:

- Executive Steering
- Project Steering
- Clinical Steering
- IT Steering

Clinical governance can be planned well ahead of the project commencing as discussed earlier in the chapter. The Clinical Steering Group (CSG) may in part or whole rollover from a Clinical Advisory Group (CAG) or its equivalent, established during the vendor selection phase. This will usually sit above a number of subcommittees and working groups and will be tasked with expediting escalated decisions. The composition of a typical EMR Clinical Steering Group is shown in Table 15.6.

Table 15.6 Clinical Steering Group membership and responsibilities example

Membership	Sample responsibilities
• CMIO/CCIO/CNIO • Key medical, nursing, AHP, pharmacy stakeholders • ICT representation • Vendor representation • Patient advocacy as required • GP/Other health service representation as required	• Review or set organisational procedures and policies that need to be modified or introduced • Escalation of design decisions with workflow or clinical impact • Provision of clinical SMEs from across the organisation • Endorsement of key clinical design decisions and processes • Shared ownership of expected clinical related outcomes

15.8.2 Establishing Clinical Workgroups

Adequate resourcing of clinical subject matter experts in work groups is essential if the project is to have a critical level of clinical engagement and decision-making. It also represents a significant challenge in medical workforce rostering, significant costs of backfill and may necessitate appointing supplementary staff. The vendor and other health services that have undergone implementation will be able to guide resourcing estimates through different phases of the project.

For larger projects involving multiple clinical services, it is important to address the following questions in ensuring balanced workgroup composition.

- Is there adequate representation from the clinical services impacted?
- Is there adequate representation from each of the facilities impacted if multiple facilities are involved?
- Is there enough focus on hospital-wide capabilities being implemented that have a significant impact on all clinical users, for example, medication management?

15.8.3 Chartering the Course of Design, Build and Test

The approach to information technology-enabled change is often broken into the well-known triad of "people, process, and technology". It is widely recognised that "people & process" are by far the more complex and challenging pieces of the triad. Understanding culture, people's requirements, expectations and keeping stakeholders motivated to implement change are critical to success. Understanding workflows and processes are also critical and support the delivery of:

- Current state workflows, for example, discharge to home from inpatient
- Clinical content, for example, care pathway or medical protocol content
- Design decisions, for example, escalation triggers for deteriorating patients

- Future state workflows, for example, electronic clinical handover
- Unit testing, for example, clinical user scenarios, queries from testing team
- Clinical champion development
- Clinical process improvement as part of the outcomes and value framework
- Training and go-live support, for example, of superusers that are more highly trained users of the system that can support inexperienced users at go live and beyond

So what tactics can be applied to get people involved and stay motivated in these long complex projects? The answers vary widely and often depend on the drivers of individuals. Some clinicians may be self-selecting with a natural bent towards health IT, or desire to have a key role in a large transformation program or seek an opportunity to develop new skills. Others may expect financial reimbursement for their time. It is important to evaluate these factors up front and plan for any additional activity or costs that might be incurred.

A project charter is a document that describes important high-level aspects of the project. It should be agreed and signed by all of the workgroup members to mark an understanding, agreement and commitment to the project. The type of information that would be included are:

- Purpose of the project
- Workgroup objective
- Decision-making processes such escalations or conflict resolution
- Guiding principles
- Membership
- Success measures of the workgroup

15.9 The EMR Journey: Go-Live

The effort invested during the system design, build and test phases culminates in final preparations for the go-live and then the go-live itself. Critical success factors for this phase are:

- Thorough testing of the system
- Robust conversion and cutover planning, which describe the project steps to bring the EMR into real use, such as converting a paper-based medication chart to an electronic one if medications management is being implemented
- Sufficient coverage and completeness of end-user training
- Training and preparation of superusers
- Adequate support for go live

One of the main go-live planning activities is the decision on how to go about go-live.

- Which clinical services or locations will "go live" first?
- How will subsequent clinical services, locations, workflows/functions phased into following go-lives?
- What day and time is best to go-live? For example, when is the activity lull in ED for an ED implementation?
- When can downtime be best tolerated if using an existing system?

The EMR training teams should have delivered the majority of their training by the time the EMR goes live. The timing of the training is very important and ideally should not be too far out from launch. If it is too far out, staff forget, if it is too recent it becomes challenging to deliver such copious amounts of training to a big workforce in a brief time. Training needs vary across professional groups and need to be tailored based on preferences and the level of impact of the systems being implemented. For medical staff, it is often challenging getting people along to formalised training, and this group often prefer online training rather than formal classroom training. Superuser "elbow to elbow" support over the time of go-live and the initial support period works very well, particularly if attendance and compliance are not great in any classroom-based programs.

EMR training and passing competency-based assessments are becoming a requirement at some healthcare organisations in Australia. In some case, being mandated before temporary staff can fill casual or locum shifts at EMR-enabled organisations.

The quality of superuser training is very important as is the superuser to other end-user

ratio. This ratio will depend on the level of scope, impact on the various clinical groups and how the go-live is phased. If the go-live conversion impacts multiple wards at once for example, a greater number of superusers is required than phasing 2–3 wards day by day.

On the day of go-live, it is very important to have clinical champions, clinical service leads and senior executives visibly involved and showing support for the project and to keep morale high. The go-live support team plays a vital role in getting the users over the line in the first 24–72 h. The level of support should be thoughtfully ramped down over the following weeks and months, allowing for the transition of staff teams and visiting medical staff working for the first time after the initial go-live.

15.10 The EMR Journey: Post Go-Live

It would be simple to think that once the go-live has occurred and the go-live support team has handed over to the business as a usual team that the job is complete. However, another health IT mantra is that an EMR is never really done.

There will be code upgrades, new technologies to evaluate and enable, new clinical services to deploy to and so on. But this should not detract from the need to get behind and celebrate the success of the project going live. These are not trivial projects and they involve a significant investment and commitment from all those involved. Celebrating success and public recognition of the staff's efforts is important to keep people motivated for the next rollout phase or project down the track.

15.10.1 Fostering an Ongoing Team

Expertise in health information technology is becoming a valuable commodity and there are recognised shortages of skilled resources in many areas. Pockets of expertise are accumulating, but the demand will only increase as hospitals and other health segments utilise more health information technology over the coming years.

There should be a good representation of clinical stakeholders within the government that supports the organisation's ongoing health IT strategy and delivery. The need for clinical leadership from the CMIO, CCIO or the CNIO has to be viewed as an ongoing committed role if care delivery and transformation supported by information technology are key to an organisation's operations.

As digital foundations are rolled out across the healthcare continuum, increasing value will be placed on a broader health IT team. Organisations will need access to a workforce with skills and knowledge in application development, data analytics computer science, and solution architecture (expertise that cobbles together the most appropriate applications and technology platform) in order to take advantage of emerging technologies such as advanced analytics and artificial intelligence.

15.10.2 Evaluating Success

As part of an outcomes and benefits framework, it is vital to ensure sufficient resourcing and project support to evaluate if the program's expected outcomes were realised. This is also an opportunity to identify gaps in cases where they have not. This effort is often left, due to cost and resource contention on other projects. It is however strongly encouraged for organisations to preserve this effort as the results can reinforce the success of the project and be a catalyst to learn for subsequent projects and serve as a valuable input into future business cases.

In general, most outcomes should be evaluated at around 6 months post go-live. By this time, users should be well versed in the system and teething issues should be resolved. Evaluation approaches depend on what is being measured. Some approaches are:

- System reports, for example, looking at drug interaction alert details
- Satisfaction surveys, for example, looking at patient or consumer and clinician satisfaction
- Observational analysis, for example, looking at clinician time and motion impacts

15.10.3 Optimisation of the EMR

Inevitably there will be changes and enhancements that will arise after go-live. Setting aside budget and resources for an optimisation phase (where suboptimal process, training and system configuration is reviewed) is strongly recommended so that necessary changes can be introduced into the live environment.

Many vendors will conduct a post-implementation review in collaboration with the healthcare organisation EMR team. These usually result in a series of post-implementation and optimisation recommendations such as configuration changes, new code upgrades, and implementing additional capabilities. It also serves as a valuable input into informing a strategic digital health roadmap, etc.

15.11 Case Study: Medical Leadership in Rollout of Australia's First Fully Integrated Digital Hospital

15.11.1 Background

In 2011, the Australian Federal Government, via the Hospital and Health Fund (HHF), granted UnitingCare Health (UCH) $47 million of a total of $96 million towards the cost of a brand-new hospital. This particular initiative was targeting the development of the first fully integrated digital hospital in Australia.

The new 96-bed hospital, St Stephen's Hospital (St Stephen's) in Hervey Bay, opened the 13th of October 2014. The hospital opened with a full suite of integrated eHealth tools. This included 29 clinical software applications, full device connectivity, 5 clinical interfaces, and 13 business interfaces. The vendor delivering the applications was Cerner Corporation, a large American healthcare software company.

As a key starting point for the project, UnitingCare Health's Executive Director, with vision and a strong commitment to the delivery of a fully integrated digital hospital, took himself to study digital hospitals that were successful and not successful in their implementation. The key lessons he brought back to Australia were the catalysts for the recruitment of an experienced eHealth Program Director and the appointment of Australia's first CMIO. The combination of a highly committed leader, an experienced program director and engaged medical leadership set the scene to the start of a successful project.

The large clinical transformational change in this project was achieved through the creation and integration of Work Redesign Teams (WRTs). A total of eight WRTs were created, three of them medical teams which will be discussed further (Fig. 15.2).

Each team worked independently, however, in close synch with each other during seven intense months. Items that were considered to have an effect on the other teams were sent for discussion and decision by the other WRTs.

15.11.2 Project Clinical Governance

A robust clinical governance process was established with the use of the well-established governance groups already in place. The UCH Clinical Governance Committee chaired by the Chief Medical Officer and local Medical Advisory Committees were some of the key groups that were already established but joined the project governance, as well as the development of new governance groups. Guiding principles, developed and agreed by the WRTs, provided the fundamental pillars for decision and escalation.

A new eHealth clinical governance group was established as a subcommittee of the existing UCH Clinical Governance Committee composed of the clinical leaders from across the group and was chaired by the CMIO. This group, named SAGE (Strategic Advisory Group for eHealth), reviewed and decided any issues that could have a major impact across the group, were considered high risk and/or were escalated by the WRTs.

The governance for the non-clinical areas was established via a robust structure with a peak governing body chaired by the Executive Director. His commitment, guidance and leadership made a direct oversight and positive stewardship.

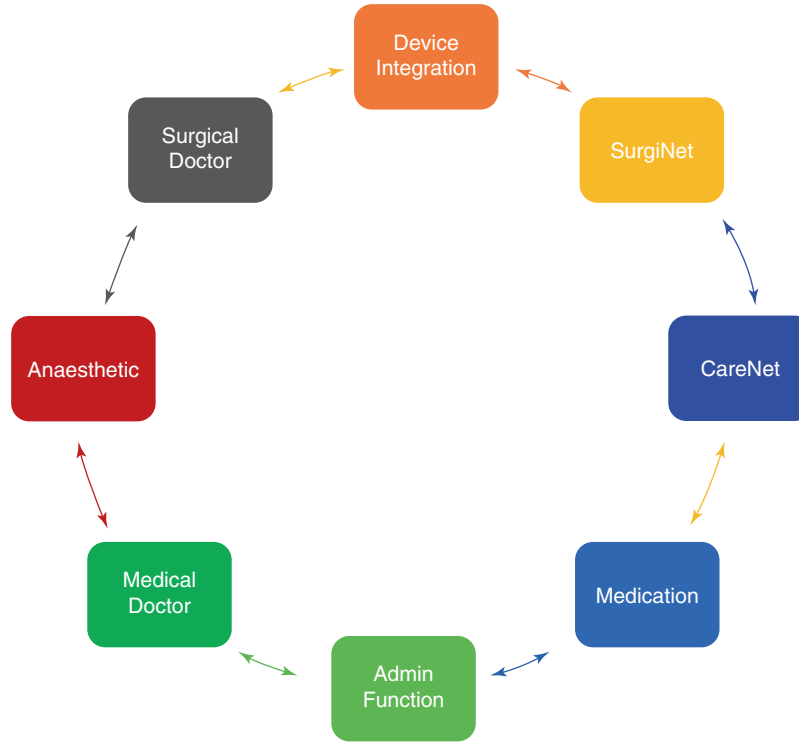

Fig. 15.2 Clinical transformation and work redesign teams

15.11.3 Medical Engagement

A key to the successful opening of the new hospital was the strong medical engagement throughout the project. It is important to note the appointment of the Chief Medical Information Officer for UCH was a combined role with Director of Medical Services for SSH.

The medical engagement model utilised at SSH can be divided into three phases: Pre-implementation, Implementation (Go-Live) and Post-implementation (Fig. 15.3). The two drivers in the medical engagement strategy were a close partnership with all our medical colleagues while providing them with a tailored approach that covered the doctor's individual needs.

15.11.4 Pre-implementation: Phase 1

Early in 2013, invitations outlining the vision and scope of the project were mailed to all Visiting Medical Practitioners (VMPs) working for UHC between Hervey Bay and Brisbane. A high number of doctors from across medical and surgical specialities, as well as different levels of seniority, expressed interest in working at SSH.

Medical Work Redesign Teams (WRTs) were established with a total of 27 doctors. Initially divided into Medical and Surgical teams, it became clear that a third team for Anaesthetics would be required. Each Medical WRT was chaired by an elected VMP and facilitated by the CMIO (Fig. 15.4).

The focus of the WRTs was to provide guidance in the design of the EMR based on Evidence-Based Medicine and National Guidelines. This incorporated clinical protocols in 43 Diagnostics Related Groups, patients were more frequently admitted to SSH and those which were considered higher risk, for example, Sepsis and Warfarin management. The Medical WRT doctors acted as the clinical leads and representatives of their speciality. A panel of experts was selected to form an Advisory Board. Specialties which were not present at SSH, such as from cardiology, general practice, and emergency medicine, were also consulted.

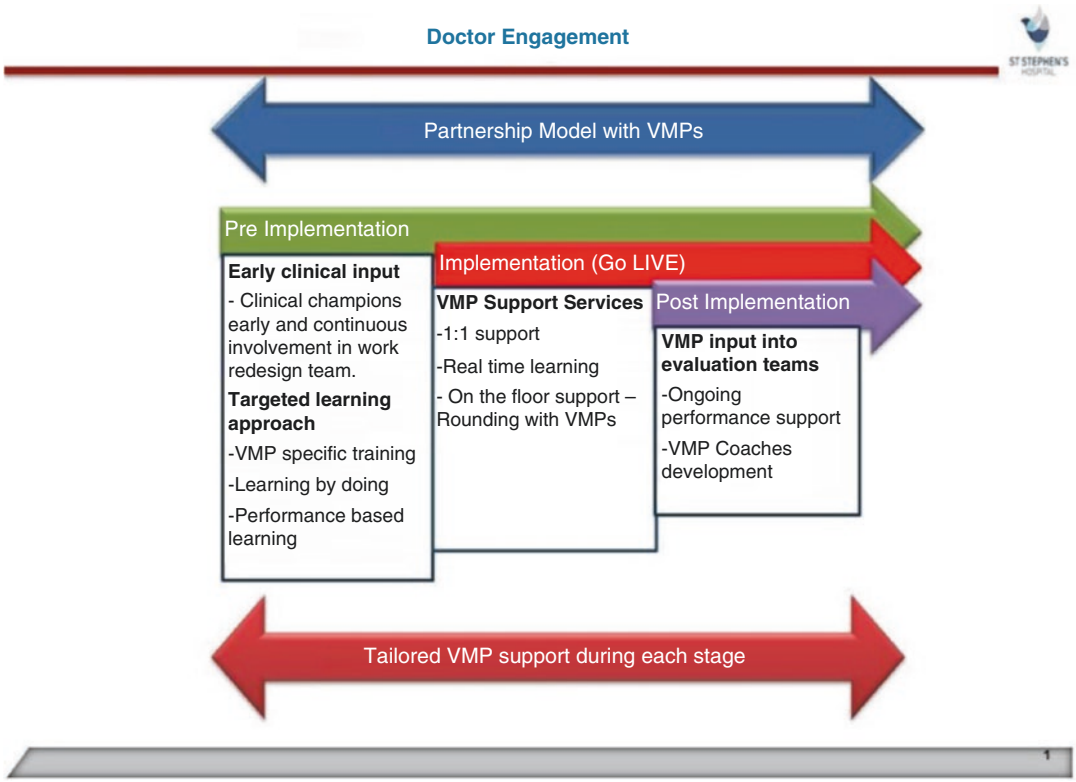

Fig. 15.3 Medical engagement phases for St Stephen's Hospital. (Courtesy of Uniting Care Health and St. Stephen's Hospital)

The core team of eHealth Program Director, Cerner representatives, including their Physician Executive, eHealth Learning and Change Manager, Clinical applications Project Manager, Assistant CMIO and the CMIO spent a lot of time preparing for the WRT meetings.

After 10 weeks of intense effort, the initial design of the EMR was completed. The meetings across three different locations across the Queensland proved to be a logistical challenge, which was overcome by video-conferencing and a shared web-based meeting application. It was not easy, as both the Vendor and the WRTs Doctors were doing this for the first time in Australia and at times the views of both parties clashed. This is where the role of the CMIO was critical as it was important to make sure that the clinician concerns were addressed appropriately and in a timely fashion.

Designing a greenfield system with no previous experience and without the support of peers with any experience was an extremely challenging exercise. The majority of VMPs utilised a practice management software with an element of digitisation in their offices and therefore the comparison to their practice clinical information system was inevitable and posed a significant challenge. The project arranged a visit by a member of each WRT to sites in the USA with a fully integrated EMR sites in the USA.

Clinical champions emerging during the design phase later became the subject matter experts who assisted supporting their peers on the floor (Superusers). The Superusers performed a key role in driving adoption amongst their clinical peers.

There was a Superusers identified in each medical anaesthetic and surgical WRT. All three were passionate about driving safety and quality improvements to patient care. These individuals became experts in the EMR and clinical leads in the day-to-day operations of the system.

A Doctor's Workshop was organised in February 2014 following the US visit where their findings of their visit, as well as the WRT's efforts, were shared with their colleagues. This

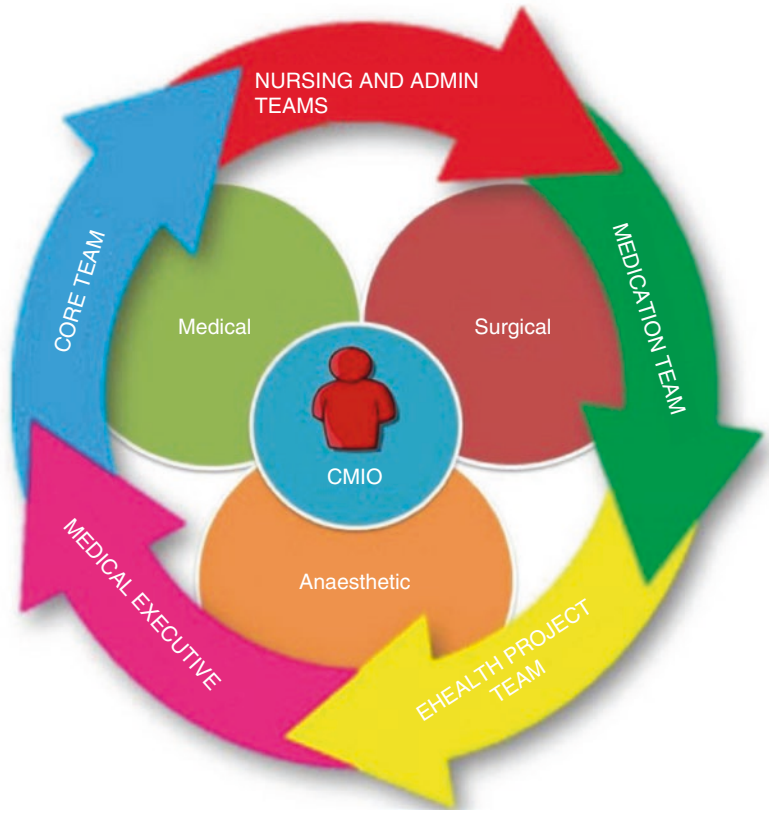

Fig. 15.4 Doctor redesign teams and key stakeholder teams for St Stephen's Hospital project. (Courtesy of Uniting Care Health and St. Stephen's Hospital)

kicked off the learning and change phase, one which saw the development and agreement of individual learning plans leading to tailored training sessions. All VMP's were provided with individual training, an average of 6 hours per doctor. Although the CMIO provided most of the training to those VMPs with a high volume of admissions, essential additional support was provided by doctor Superusers (Chief Medical Officer UCH, Chair of Medical WRT, Chair of Anaesthetics WRT and Assistant CMIO).

It cannot be emphasised enough how important the 1:1 Doctor Training is for the senior Consultant group. If considering training for a larger organisation, alternative methods such as web-based learning and group training are recommended for the junior medical staff, as they are comfortable and used to that type of training. A train the trainer model can be used for the senior medical staff, where a peer will always be the one providing the training. The advantages of the 1:1 training are extensive as senior staff are the leaders of the multidisciplinary teams and it is imperative that they have a full understanding of how to use the system to ensure adequate patient care. During this individual 1:1 session, they can be loading their templates to ensure that the day of go-live as much as can be done beforehand is accomplished, increasing use and adoption of the system.

Alongside the development of the learning guides and plans, the doctor Superusers joined the eHealth team in the testing phase, including two Mock Go Live exercises, and proved to be critical members of the team with invaluable feedback and camaraderie.

15.11.5 Implementation or Go-Live: Phase 2

In preparation for the Go-live phase, a Medical Support Roster was developed with full Doctor coverage 24 h 7 days a week by the CMIO and Dr. Superusers. It is important to note that the Chief Medical Officer (CMO) for UCH was

part of the doctor Superuser group. The support of the CMO was absolutely indispensable during design and more importantly during go-live. Having an extremely experienced clinician with a high level of authority allowed for clinical governance matters to be identified, escalated and addressed at an incredibly fast pace. His leadership, support and dedication to the medical support team supported the high importance given to the medical engagement strategy by the Projects.

A progressively increasing theatre schedule was agreed by the surgical group with full operating theatre schedule to be running by the third week after opening. Doctor support was assigned between the operating theatre and inpatient wards, providing 1:1 elbow-to-elbow assistance. The presence of Cerner's Adoption coaches and Cerner's Learning Architect on site during Go-live proved to be invaluable - with hands-on assistance when required, working alongside the eHealth team's Clinical Applications Manager and Learning and Change Manager. This highly enthusiastic and committed group, backed by a large structure designed around a Command and Coordination Model, provided quick turnaround in changes required by the clinicians on the floor. The Command Centre was staffed mainly by the eHealth Program Director, a highly experienced CEO with an uncanny ability to identify and manage risks early who was also extremely charismatic and passionate and the CIO—who had only newly joined UCH, yet also had previous experience in EMR deployment overseas and proved a valuable resource. The governance structure devised to deal with changes or enhancements and issues identified was a rapid Change Advisory Board—"CAB Lite". Daily or sometimes twice daily meetings were undertaken to deal with the requests in a timely manner. Extraordinary meetings of the Specialty Groups were held to discuss the progress of the changes requested and obtain agreement for their advancement.

The 1:1 Doctor support model was rostered for 6 weeks, with gradual reduction of its intensity. Resources were directed to those who requested additional support and areas that required the most number of changes.

The time of go-live was a gruelling time. Long days up to 20 h of support and CMIO presence on-site were required. This level of support was required continuously for 6 weeks post go-live, posing a significant challenge for this period on top of the sheer physical exhaustion from team members.

The Program Director identified this early on and provided relief and support but in the end, it was her ability to keep everyone engaged that alleviated the challenges.

15.11.6 Post-implementation: Phase 3

The go-live phase morphed into the post-implementation phase; 6 weeks after go-live resources weaned down, and plans were put into place to transition the eHealth team and technical support from the eHealth Program Director leadership to the Chief Information Officer.

Several ad hoc meetings were held with the speciality groups at SSH to work collaboratively and quickly on issues identified and changes required. Communication of changes was done in a variety of ways: by email, noticeboards, meetings and face-to-face.

An analysis that was undertaken internally by the team 2 weeks after go-live revealed that there was a 92% adoption rate amongst the Doctors. The vendor leadership team members noted anecdotally that this high adoption percentage was rare and unique in their experience such a brief time frame after opening a new hospital. The 1st of December 2014, SSH was awarded HIMSS Stage 6, the first hospital in Australia to achieve this accomplishment.

Originally thought to require 3 months of local support by the Clinical Informatics team (previously EHealth project team), 6 months post go-live support is required on a weekly basis.

15.11.7 Key Lessons Learned

- Top leadership engagement is essential for the project to succeed. The dedication and commitment from the Executive Director, the Program Director and the CMO was invaluable. Their ability to understand the problems, trust their teams and support their vision provided us with the leverage to achieve what had not previously been achieved in Australia.
- Early engagement of clinicians, in particular, the medical practitioners, fosters a platform for true collaboration and high adoption of the EMR ensuring the end product is safe and usable.
- Pharmacists engaged early focussing on medicines management and medication safety will ensure you have a strong platform for safe use of the EMR. They are a key resource to support clinical safety and your medical workforce on the floor during and after go-live.
- The role of the CMIO is an absolutely essential position for any kind of EMR project.
- The learning phase needs to be planned carefully and practically in order to accommodate everyone's learning needs and favourite tools prior to go-live.
- The go-live period can be very gruelling and taxing on your team; make sure you have a planned roster with breaks in order to allow everyone to be at their best when rostered on.
- The go-live period requires a quick and responsive governance team due to the considerable number of changes requested that need to be evaluated, tested and implemented within a very short time frame.
- The patient perspective: During the go-live period it is important to note that there is a large number of people in each patient's room as they are supporting the clinicians on the floor. At times there could be up to more than five people providing support to different members of the clinical team; this can be very daunting to a patient. Make sure you allocate a separate role to a patient navigator whose key role is to ensure that the patients are being kept up to date with what is happening.

The key message from this case study is that this is not an IT project. It is, at the very core, a people project and as such needs to be managed as a transformation of the way healthcare is delivered rather than the design of an EMR.

Last but not least, our success was not one that can be attributed to one factor. The confluence of the right people, at the right time, with the right leadership was what made it happen. But technology is only as good as those that use it, in SSH we found a group of doctors, nurses and pharmacists who understood and shared the vision of delivering something truly unique. In the end, the success belongs to them: those clinicians at the coal face who deliver care on a day-to-day basis in a hospital which has now created Australian history and paved the way for the future of healthcare.

15.12 The Future of Health IT

We started this chapter with a look at health IT's evolution with a focus on implementing clinical systems and EMRs into hospitals. Although there is more to be done and large programs of EMR implementation are well underway, there is more work remaining to have these foundational systems of record in place.

As financial, service demand and other pressures continue to mount on health services, there is increasing focus to pivot from systems of record to systems of insight and intelligence. Health services want to use EMR and other data to gain clinical and operational insights previously impossible with paper records. A number of health services are using this data to develop predictive models, such as the risk of a subsequent unplanned readmission or early deterioration. Natural language processing technologies are able to interpret different sources of textual information to pull out key information. An example is flagging significant abnormal findings in radiology reports for patients that have been discharged from the hospital.

The intersection of healthcare provision, information and medical technologies is creating

new possibilities and marks an exciting future and one that can make a real impact in supporting quality care. Below are some of the emerging themes and trends in technology that are most likely to impact healthcare in the near future.

15.12.1 EMR Trends

- Patient-generated health data (PGHD) into EMRs and for EMR data to be available in patient and consumer applications.
- Real-time predictive analytics based on data in the EMR for example sepsis alerts and estimated length of stay.
- Interoperability from and between EMRs and patient and consumer applications using emerging interoperability and application standards, namely Substitutable Medical Apps, Reusable Technology on FHIR (otherwise known as SMART on FHIR). This allows third-party applications to be used within compliant EMRs.
- Decision support tools that can support clinical and personalised decision-making, examples ranging from pharmacogenomic decision support to precision dosing platforms for medications with a narrow therapeutic index.
- EMR data increasingly used to identify potential candidates of patients for clinical trials real time.
- Improved user interface and user experience design.
- Connections between EMRs and medical devices, such as infusion pumps and monitors.
- Telehealth and virtual consultation platforms are becoming more integrated into clinical systems and EMRs.

15.12.2 Digital Health and Technology Trends

- Faster mobile connectivity with emerging 5G will enable higher bandwidth mobile health uses such as video consultation, as well as lower battery consumption for connected devices.
- Hyperscale cloud service providers are lowering the cost of computing infrastructure and commoditising access to high-performance computing that is needed for processing of genomic data for example. Cloud platforms also enable agile application development tools, as well as connectivity and management of medical devices through the internet of things.
- Development of artificial intelligence and other cognitive service platforms for language translation, image machine learning, computer visualisation, chatbots.
- Artificial intelligence is being used in some specific use cases in healthcare, such as radiology image assessment. These are not yet being used in day-to-day clinical environments, but the technology is rapidly advancing.
- Secure messaging and eReferral capabilities across the health system are becoming increasingly standardised to support better interoperability.
- Payment model trials from fee for service to capitated or value-based payments driving needs for risk stratification, care management, case coordination, population analytics. One such example is the GP Health Care Homes trial in Australia.
- Video consultation and teleconsultation platforms have emerged to give patients alternative consultation mechanisms with their providers.
- Innovations in diagnostics are enabling more point of care pathology testing. Smartphones and smaller imaging tools such as handheld ultrasound scanners are increasingly being considered in aggregating clinical information around a patient.
- Increasing consideration is being given to cybersecurity practices in healthcare, including appointments of CISOs (Chief Information Security Officer's).

Like most countries, Australia is facing an inflexion point in health with a collision of demands, such as ageing and an abundant burden of chronic disease, outpacing our ability to

resource and manage them if we continue with the status quo. Governments have the unenviable task of curtailing costs and inevitably, these forces will more than likely lead to rationing of services and push new types of healthcare and payment models. Consumers and patients will have to support their own care more than they might today and all within an increasingly complex health information landscape.

All of these changes drive a need for digital health technology. It is not the technology alone that will drive change in healthcare systems, but it is well recognised that technology has already changed many aspects of our lives and this is likely to be true in healthcare in the future. The success of information technology and its utilisation in healthcare will be in its ongoing ability to evolve, adapt to new standards and technology and to ensure healthy doses of participation in its design and use from clinicians and patients.

15.13 Ready Reckoner

The key points covered in this chapter are:

- Health information technology is a relatively recent specialist area within technology and healthcare has been later in mass digitisation of information than other industries.
- Business cases built around improving information efficiencies, quality and safety can be supported by achievements from healthcare organisations that have invested in these technologies.
- In embarking on an implementation of an EMR, it is crucial for an organisation to have a cohesive vision, reason for change and objectives.
- Implementation programs that are centred around the patient and improving safety and quality outcomes will carry much more sway and support from across the organisation.
- Critical success factors include strong executive support and sponsorship of the project (made even more potent if the key sponsor is the CEO) and appointment of CMIO/CCIO/CNIO roles.
- The success of these programs is much more about getting right the process and change management rather than the technology. A well thought out governance structure is integral to achieve this.
- When considering scope of an EMR implementation, keep in mind what will give the greatest value in a reasonable timeframe—EMRs will continue to evolve and there will be an ongoing need to enable more services, optimise an existing implementation and add new technologies (such as mobility).
- As much as possible, leverage the experience of organisations globally and locally that have undergone implementation of an EMR, as well as the experience of the selected vendor.
- The case study of St Stephen's Hospital provides a very useful real-world example of how medical stakeholders were engaged in this beacon project.
- Health information technology will play more of a part as a strategic and essential tool in how we deliver care. Already we are seeing EMR systems provide more intelligence to clinical care with predictive analytics, and consumers engaging with medical information with their own mobile devices and platforms. Bringing this information together to effect good outcomes for the patient and population across the continuum of care is the future direction
- The future of health information technology will also be driven in part by the emergence and development of large cloud services and capabilities as they can provide a scale that was not there previously

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