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## The Digital Transformation Journey of a Large Australian Hospital: A Teaching Case

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## Accepted Manuscript

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## The Digital Transformation Journey of a Large Australian Hospital: A Teaching Case

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### Abstract:

With the vision of a seamless, state-wide approach to patient management, the Department of Health within the Queensland State Government of Australia embarked on a digital transformation journey. This involved the configuration and rollout of an integrated electronic medical record system (ieMR) with computerized provider order entry, ePrescribing, decision support, analytics, and research functionalities, together with new devices and work practices, to create a multi-hospital, whole-of-state digital health ecosystem. Drawing on multiple perspectives, including executives and front-line clinicians who are both optimistic and pessimistic towards the ieMR, this teaching case describes the digital transformation of the lead site, Princess Alexandra Hospital, and their experience in becoming Australia's first large digital hospital. This case has been informed by a multi-year qualitative study involving the collection of primary (observations and interviews) and secondary data (publicly available project records) before and after the implementation. This case is relevant to undergraduate and postgraduate students in information systems, executive management, and clinical/health informatics.

**Keywords:** Digital Transformation, Electronic Medical Record Systems, eHealth, Teaching Case.

[Department statements, if appropriate, will be added by the editors. Teaching cases and panel reports will have a statement, which is also added by the editors.]

[Note: Country names may be used if the authors are from different countries. USA is used for US authors.]

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## 1 Introduction

Four years have passed since the Princess Alexandra Hospital of Metro South Hospital and Health Service (HHS) implemented an integrated electronic medical record system, becoming the first quaternary level digital hospital in Australia. Since then, all other hospitals in Metro South HHS and a further nine hospitals in the State have gone live with the system with the aim of creating a state-wide digital health ecosystem. The Chief Information Officer of Metro South HHS was conversing on the digital transformation journey with two front line clinicians detailing his perspective about how far they have progressed through the state-wide eHealth initiative.<sup>1</sup>

The Chief Information Officer expressed to his two colleagues that the journey had not been easy given the political milieu and unabated media scrutiny. At times, he felt the digital hospital program had been used as a political battering ram, highlighting that a member of the State's opposition party had stated:

*"The health minister and his technical bungles with the [information communication technologies] once again. When it comes to technology and health, boy, Queensland Labor (political party) have a shocker of a record. They introduced in the health department a \$1.2 billion system called the ieMR—the integrated electronic management record system—designed to manage patient records electronically. So far, 16 hospitals have moved onto the system and another 14 are to follow. But according to the ABC, ...95 patients have been physically harmed as a result of glitches in this system. ...It's out of control. This is life-and-death stuff that comes down to the incompetence of [the minister] yet again." (Australian Liberal Party Member – Stoker (2020))*

He also conveyed discontent with media outlets publishing sensationalized news stories about the project with headlines such as "Queensland Health's troubled year of bungles, crashes and crises" (Stone & Layt, 2019), and "Queenslanders' health at risk from electronic medical record software, clinicians say" (Stone, 2019). Given all this political and media scrutiny, he felt it was a very risky time for leaders of the project and the health services.

In expressing his frustrations of the bureaucratic and media-laced broader institutional environment with his two colleagues, the Chief Information Officer highlighted that despite the scrutiny and risks he believed in the digital hospital initiative. The Chief Information Officer cited evidence from benefit evaluations at the Princess Alexandra Hospital suggesting that the new systems decreased the number of serious falls in the hospital by 11%, reduced medication errors by 8%, decreased infections by 37%, and reduced pressure injuries by 56% (Miles, 2018). One of the front-line clinicians spoke up reinforcing the Chief Information Officer's positive appraisal highlighting that true transformation of patient care was occurring in pockets of the Princess Alexandra Hospital through the innovative use of data captured by the system. The Chief Information Officer concurred and said that the true benefits of the system would come from how the data was leveraged, reiterating what another senior colleague had said:

*"I suspect that we are perched on a precipice, a huge opportunity... No one knows what it is and no one can describe it, but you can start to see it." (Executive D)*

The previously silent front-line clinician interjected criticizing elements of the digital transformation raising concerns over training and involvement, fit for purpose functionality, and fears over the availability of ongoing support. The Chief Information Officer acknowledges these concerns reflecting on improvements to training and involvement as the initiative progressed. The Chief Information Officer also recognized there were many tensions around how to optimize the digital hospital, support the transformation across

<sup>1</sup> This case has been informed by a multi-year qualitative case study that involved the collection of primary data (observations and interviews) and secondary data (publicly-available records about the project) both before and after the implementation of the eHealth systems. The interviews were held with around 300 staff from different areas of the health service. In this teaching case, the way we report individuals' identities depends on the source of evidence. When a quote is from publicly available records, the individual's name is provided. When a quote is from our interviews, it is anonymised. To maintain anonymity, the Chief Information Officer perspective outlined throughout this teaching case is drawn from different participants with similar roles who experienced similar challenges. Similarly, the positive and negative front-line clinician accounts are based on multiple clinicians who held either positive or negative views respectively. This is in line with previous work that focuses on learning lessons from what happened in cases while still protecting the people involved Burke, T. K. (2007). Providing ethics a space on the page: social work and ethnography as a case in point. *Qualitative Social Work*, 6(2), 177-195, Burton-Jones, A., Akhlaghpour, S., Ayre, S., Barde, P., Staib, A., & Sullivan, C. (2020). Changing the conversation on evaluating digital transformation in healthcare: Insights from an institutional analysis. *Information and Organization*, 30(1), 1-16.

the HHS, while servicing the day-to-day needs of a major health service. The Chief Information Officer knew the key to success would be to balance these tensions, yet was unsure how best he and other leaders should do so, especially in such a high-pressure context.

This teaching case<sup>2</sup> describes Princess Alexandra Hospital's digital transformation to become Australia's first digital quaternary level care public hospital as part of the larger state-wide transformation, which is still unfolding. In Section 2, the strategy and aims of Queensland Health and Princess Alexandra Hospital is described. Subsequently, in Section 3 the information systems core to the digital transformation initiative are detailed. Followed by Section 4, which describes the digital transformation stages with emphasis on clinicians' and executives' perceptions of Princess Alexandra Hospital's transformation. Following, in Section 5 the current outcomes of the digital transformation are described. The teaching case concludes, in Section 6, with the ongoing tensions facing the Chief Information Officer, informed by positive and negative appraisals, resulting from the ongoing digital transformation efforts.

## 2 Queensland Health Context

Princess Alexandra Hospital is embedded in the Metro South Hospital and Health Service (HHS), which is embedded within the Department of Health in the state of Queensland, Australia (henceforth referred to as Queensland Health). Initially, Queensland Health was the driving force of the digital transformation, however over time it shifted to the lead sites (especially Princess Alexandra Hospital) to help drive the agenda – a balancing act that continued to evolve over time. In this section, the structure of Queensland Health and their eHealth strategy is first described, followed by the structure of Metro South HHS and Princess Alexandra Hospital.

### 2.1 Queensland Health Context

Queensland Health is a state government department that provides healthcare facilities to cater to the needs of over five million people (Queensland Health, 2018). It is responsible for providing public hospital healthcare to all individuals in the State, which is funded by the Government. Providing these services comes with the complexities associated with Queensland having the most geographically dispersed population of all Australian States (Queensland Health, 2013). To better manage health services across the state, Queensland Health decentralized their operations in 2012 and established sixteen HHSs (Figure 1). Each HHS operates “as a statutory body with a governing Hospital and Health Board” (Queensland Health, 2015). Decentralization of health services is thought to improve accountability, financial management, and ensure that policies are informed based on the requirements of the local context but can result in a lack of central oversight (Mannion et al., 2005). In Queensland Health, the establishment of the HHSs helped manage the diverse healthcare requirements in these geographical areas. Yet, challenges arose as clinical information was stored on physical paper medical charts creating information siloes. These challenges included: (i) coordinating care between hospitals either within a service or between services; (ii) providing effective and safe care within hospitals as decision support capabilities were limited; and (iii) obtaining data for quality improvements and research.

Given the pressures challenging effective healthcare delivery globally, such as an aging population and increasing chronic diseases (Klecun, 2016), coupled with the challenges associated with information siloes; Queensland Health believed it was paramount to digitally transform through investing in eHealth (Queensland Health, 2015):

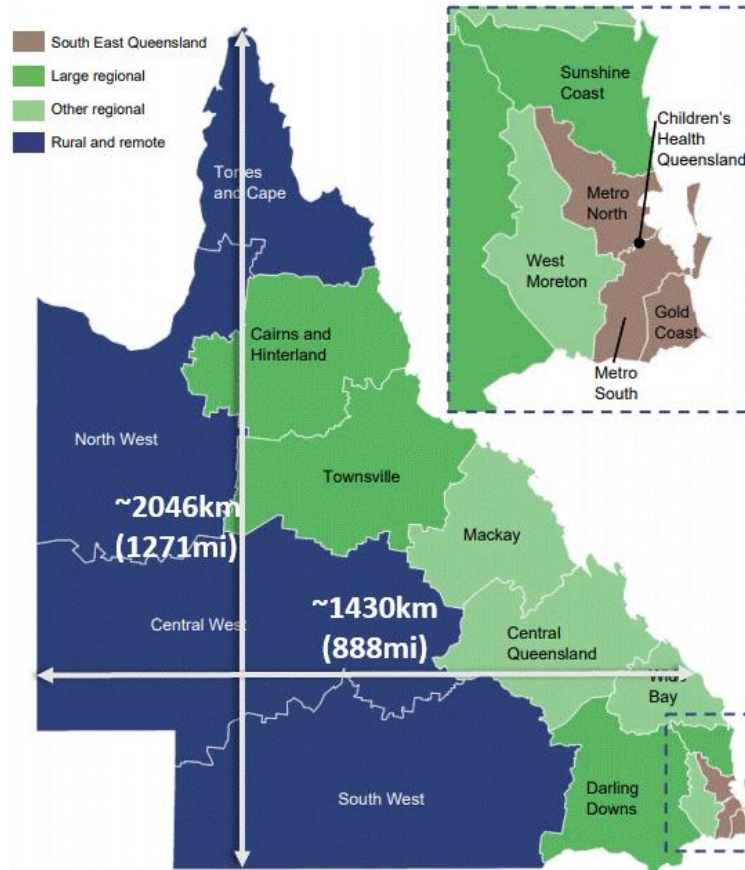
*“Information and communication technology is continually transforming the delivery of healthcare and system administration services, here and around the world. As such, investing in [information and communication technology] and innovation is a significant cornerstone of Queensland Health’s commitment to improving the healthcare of all Queenslanders.” (Director General Queensland Health (2015-2019) Michael Walsh from: Queensland Health (2015, p. 6)).*

Digital transformation is defined as “a process that aims to improve an entity by triggering significant changes to its properties through combinations of information, computing, communication, and connectivity technologies” (Vial, 2019, p. 121). It involves fundamentally rethinking an organization's processes, services, and roles from a technology-enabled perspective (Parviainen et al., 2017). To

<sup>2</sup> Teaching notes are available from the first author upon request.

digitally transform, Queensland Health developed an eHealth investment strategy proposing a state-wide approach to patient management.

*“Our investment in ...digital hospitals means that key information about a patient will be available wherever they present in the health system, across all HHSs” (Director General of Queensland Health (2015-2019) Michael Walsh, from: Queensland Health (2015))*



**Figure 1. Queensland Health Hospital and Health Services (Source “Hospital and Health Services Maps” adapted from Queensland health (2019, p. 4))**

In accordance with the Queensland Audit Office (2018, p. 67) five key drivers motivated the need for an eHealth investment strategy:

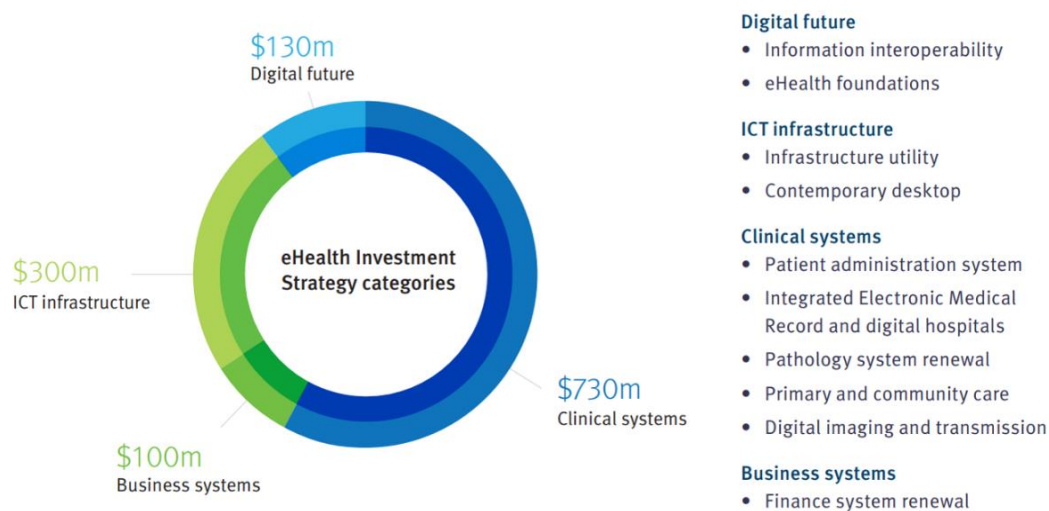
- Political: State-wide eHealth outlined as a key priority, with the goal of seamlessly accessing patient clinical information between hospitals in the state.
- Economical: To decrease the costs of healthcare delivery through improving the efficiency and effectiveness of care, and minimising the need for physical resources.
- Social: Australia has an aging population (projected to be 7.1 million people over 65 in 2036), with increasing burden of chronic disease, which places greater pressure on healthcare delivery.
- Technological: Continual improvements in eHealth minimises the risk of human error and provides capabilities to provide transparent sharing of clinical patient information.
- Legal: Hospitals, HHSs, and the government can be held legally responsible for situations which result in patient harm. As a result, a legible and transparent patient record is necessary to identify points of accountability.

The multifaceted eHealth strategy (figure 2) required an investment of more than one billion AUD. This included \$100 million AUD to upgrade and replace existing business systems; \$300 million AUD to improve information and communication technology infrastructure to ensure the networks can handle the

increased capacity; \$130 million AUD to support the digital future of Queensland Health providing interoperability between different levels of healthcare service (i.e., between general practitioners and hospitals); and \$730 million AUD to improving clinical information systems of which \$376 million AUD was initially allocated to the integrated electronic medical record system. The integrated electronic medical record system was to serve as the foundation of the digital transformation of the State's healthcare enabling the transition from outdated paper-based recording of patient's clinical data onto a digital platform to support clinical decision making, develop new models of care, facilitate more effective research and administration, and provide a foundation to transform the State's healthcare through a network of interconnected digital hospitals.

*"Queensland Health is establishing the foundations of a digital health system. ...Investing in innovative technologies will better support our clinicians delivering front line services, maximizing not only the value of our quality workforce, but offering a degree of mobilization that will sustain new models of care"* (Minister for Health (2015 - 2017) Cameron Dick from: Queensland Health (2015, p. 4)).

Particularly when it came to the investment of clinical information systems to support the delivery of healthcare, many were pleased and perceived it to be an inevitability to be embraced: as an executive and surgeon notes: *"The whole of Australia is going to go digital"* (Executive A); *"It's inevitable, it's inevitable that we are going electronically"* (Surgeon A)



**Figure 2. eHealth Investment Strategy (Source: "21<sup>st</sup> Century Healthcare – eHealth Investment Strategy" by Queensland Health (2015))**

As discussed in the following section, the Princess Alexandra Hospital, which resides in Metro South HHS, led Queensland Health's digital transformation becoming Australia's first quaternary level care public hospital to go digital.

## 2.2 Metro South Hospital and Health Service and Princess Alexandra Hospital

The Metro South HHS executive team, in part, consisted of standard executive positions (e.g., Chief Executive Officer, Chief Finance Officer, Chief Information Officer, and Executive Directors of: strategy and planning, human resources, governance). The executive team also had a strong clinical focus with additional executives from some of the hospitals in the service (e.g., Executive Director of the Princess Alexandra Hospital and Executive Director of Logan and Beaudesert hospitals), and executives representing key clinical areas (e.g., Executive Directors of: nursing and midwifery, medical services, allied health, and addiction and mental health).

As later described, the chief executive of the Princess Alexandra Hospital recognized the potential value of clinical information systems, specifically integrated electronic medical record systems. As a result, Princess Alexandra Hospital became the lead implementation site, paving the way for other hospitals both in the service and the State. Figure 3 shows the responsibilities of Queensland Health, Metro South HHS, and the hospitals in the digital transformation.



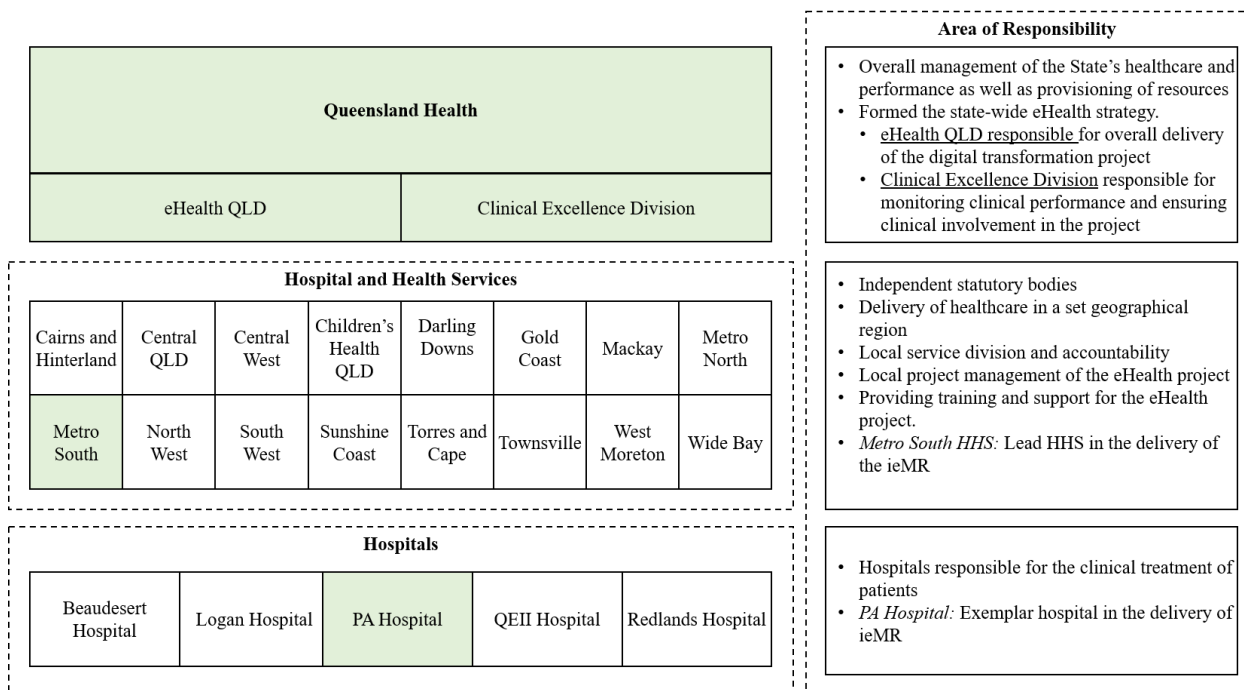


Figure 3. Organizational Structure and Responsibilities

Princess Alexandra Hospital is the most complex hospital in Metro South HHS. It is a quaternary level hospital that cares for diverse, high acuity patients (Sullivan et al., 2016). Each year, Princess Alexandra Hospital has over 100,000 patients admitted to the hospital, 61,000 admitted to the emergency department, and 500,000 outpatients per year. They have more than 5,500 full-time equivalent staff.

The Princess Alexandra Hospital prides itself on having a shared executive structure<sup>3</sup> in which all major clinical areas of the hospital (i.e., surgery, medicine, cancer, and rehabilitation) are shared equally by both a doctor and a nurse. This shared governance structure facilitates respectful interactions between professional groups and minimizes conflict between strong professional cultures often witnessed in healthcare (Fichman et al., 2011). Building a strong shared organizational culture (Schein, 2009) has been a priority of Princess Alexandra Hospital since 2000. The Princess Alexandra Hospital continuously fosters its culture. By doing so, it developed the type of change-ready and developmental culture necessary for a digital transformation project (Moss et al., 2017; West & Jennifer, 2011), as one nurse describes:

*“There is something about the culture [in this hospital] that is very can-do because I mean that is why they brought [the ieMR] in here in the first place. ...No other hospital works like we do together. ...We are very integrated all across the whole- everything you know engineers, nursing, medical. ...Most hospitals, ...staff do not even interact outside their department. ...Whereas ...we have a meeting every morning with all the people – all the nurses in charge of every single department every morning so we all know what is going on, we all see each other every day” (Surgery Nurse A).*

### 3 Information Systems Implemented

In line with the eHealth strategy, to provide a statewide approach to healthcare delivery, investment in clinical information systems was necessary. Such investments were considered critical to overcome the challenges surrounding information siloes both within and between hospitals as well as accessibility and legibility issues associated with the physical paper patient records and medication charts. In this section, we outline the clinical information system implemented, the process of the implementation and the core factors to consider during the transformation are then presented in the Section 4.

<sup>3</sup> Princess Alexandra Hospital Organizational Structure: <https://metrosouth.health.qld.gov.au/sites/default/files/org-structure-110220.pdf>

While Princess Alexandra Hospital was the lead implementation site, the clinical information system implemented was decided based on input from all hospitals in Metro South HHS as well as input from other HHSs in Queensland. It was determined that an integrated electronic medical record system (referred to as the ieMR) was required. The goal of an ieMR is to provide a completely integrated system to support the entire patient journey across all professional groups (i.e., doctors, nurses, allied health professionals, administrative personnel), units, and hospitals within both the service and the State including emergency admissions, inpatients, and outpatients but largely excluded primary care practice (i.e., general practitioners) and community care (i.e., hospital in the home, telehealth). The ieMR comprises of an electronic medical record system integrated with computerized provider order entry, ePrescribing, and computerized decision support functionalities (defined in Table 1).

**Table 1. Systems Implemented**

System	Definition (Black et al., 2011)
Electronic Medical Record	A longitudinal and electronic collection of patients' clinical information available across case settings.
Computerized Provider Order Entry	"Used by clinicians to enter, modify, review, and communicate orders; and return results for laboratory tests, radiological images, and referrals" (p. 6)
ePrescribing	"Clinical information system that are used by clinicians to enter, modify, review, and output or communicate medication prescriptions" (p. 7)
Computerized Decision Support	System which supports clinical decision making by providing real-time alerts (e.g., medication interactions, drug allergies).

The electronic medical records system was the foundational component of the ieMR and was designed to replace the physical patient paper charts and siloed standalone digital systems of the past. As such, the information that would be documented on the patient's paper chart was now inputted directly into an electronic equivalent. Likewise, the order entry system enabled requests for pathology and radiology tests to be electronically entered. The test results were also made electronically available requiring clinicians to electronically sign off upon receipt of the results (known as endorsing), enabling close-looped reporting. The ePrescribing functionality was designed to replace the previously used physical medication charts. When ePrescribing was paired with clinical decision support it enabled alerts to be created to inform clinicians of potential drug interactions and allergic reactions. Such alerts were not possible prior to the implementation of the ieMR.

Prior to selecting an ieMR, Queensland Health considered whether the State should adopt: (i) a single vendor – single system approach or (ii) a multiple vendor – multiple systems approach (best of breed solution). Through performing a benefit-to-cost ratio analysis, the single vendor approach was selected (Queensland Audit Office, 2018). The single vendor approach was primarily selected because it was considered to minimize the challenges associated with information siloes evident between the HHSs, and would ease system integration efforts, enable greater accessibility, and offer economies of scale (Queensland Audit Office, 2018). However, a single vendor approach can also result in challenges, including system fit and vendor dependency issues (Martinez et al., 2017).

Through a comprehensive competitive tendering process, Cerner was selected as the ieMR vendor. Cerner, headquartered in the United States of America, is one of the leading clinical information system vendors, although its foundations are originally in administration and billing (Webster, 2019). While Cerner technologies are predominantly designed to capture data in a way that reflects the American healthcare system, it provides eHealth technologies globally. Nevertheless, adapting a system to fit local practice is challenging (Strong & Volkoff, 2010). For instance, Australia healthcare practice is patient-centric, with public healthcare available to everyone regardless of demographics; whereas the United States healthcare system while also patient centric is not currently publicly available to everyone (Jones et al., 2011) and, as such, greater emphasis is placed on billing. Because clinicians perceived Cerner as an 'American', system tensions arose as American medical practice does not always align with Australian medical practice. As evidenced below:

*"It is an American system and American – for whatever reason – it is not a like for like service. And you would think that Americans obviously do health different and we do health different [it's effectively] trying to shoehorn your service into that." (Director of Nursing A)*

The ieMR was to be implemented using a single database instance across all hospitals in the service, and in the state. This is unlike most digital hospital projects elsewhere where each hospital implements their own systems (Adler-Milstein et al., 2017), which manifests the siloed approaches to patient treatment.

*“No one else in the world is actually doing this, so there is not an American experience that we can fall back on, so we are learning as we go. ...They have been doing electronic records, but not in the same comprehensive way that we are rolling out.” (Director of Nursing B)*

## 4 Digital Transformation Process

There are three main stages of the digital transformation. The first stage is the state-wide planning that took place between 2006 and 2014<sup>4</sup>. The second stage is the implementation at the Princess Alexandra Hospital in 2016-2017. The final stage is the rollout across Metro South HHS and other hospitals within the State between 2017 and 2021. Below we describe each stage in turn with emphasis on the transformation of Princess Alexandra Hospital as the lead site (stage 2), stage 1 serves to provide a historical contextual background, and stage 3 briefly demonstrate how the rollout has progressed over time.

### 4.1 Stage 1: State-wide Planning (2006-2014)

Queensland Health’s digital transformation commenced in 2006, when the first eHealth strategy was developed. The scope of the program was detailed in 2008, with an implementation plan agreed upon a year later. Between 2008 and 2014 the project was incredibly slow and at some points stalled. During this time Queensland Health submitted a request for proposal for an ieMR vendor in May 2010, with a standing offer agreement for licensing and professional services signed in September 2011 as well as hosting and management in December 2011 (Queensland Audit Office, 2018). In 2014, the scope and implementation strategy changed, which is when Princess Alexandra Hospital became the lead site. After Princess Alexandra Hospital became the lead site the project started gaining momentum.

Queensland Health’s slow progress was, in part, a result of the government being risk-averse to large-scale technology projects and as such key stakeholders were hesitant to take ownership. This risk aversion is not unique to the Queensland Government or healthcare, but is common in Government funded information technology projects globally across multiple domains (Mergel, 2016). Queensland Health’s risk aversion was due to a history of information technology implementation project failures. As an example, between 2007 and 2010 Queensland Health implemented an enterprise system to support payroll processing as part of a shared services initiative (Eden & Sedera, 2014). The system was delivered 18 months behind schedule and 300% over budget, costing \$1.25 billion AUD to implement, stabilize, and maintain (Chesterman, 2013). As a result, Queensland Health was placed under scrutiny, with a commission of inquiry being conducted. The risk aversion resulting from the payroll is described by an executive below:

*“After the Payroll Commission of Inquiry ... the government is really edgy about [information communication technology] and they don’t like it because it costs a lot of money, and they don’t understand it and there is a very limited political benefit.” (Executive D)*

In accordance with Abraham and Junglas (2011, p. 178) “healthcare is one such industry in which this attempt to transform with [information systems] is considered essential, yet most difficult, due to the lack of prescripts for effective implementation in the company of business process changes, as well as inhibitors, such as cost factors and institutional and social structures.” The risks of digital transformation of healthcare are well known, with substantial failures experienced elsewhere (Wachter, 2016). In the United Kingdom, a ten-year eHealth initiative was dismantled after its unsuccessful delivery, which is estimated to have cost more than ten billion pounds (Syal, 2013). According to Sheikh et al. (2014, p. 384) “the UK is still struggling with laying the foundations for hospital EHRs (Electronic Health Records)” and they have only recently established a long-term digital transformation plan. This heightens the political nature of the project as an executive notes:

*“There have been extreme [information communication technology] failures across the world where people have lost ...millions of dollars - UK (United Kingdom) and so on. Which makes [the government] even more skittish because whenever someone says, “Let’s put an electronic record system in”, and they go, “Didn’t they try and do that in the UK and ...it cost them 20*

<sup>4</sup> Many elements related to the state-wide planning phase have been discussed in the previous sections, including the eHealth strategy, key drivers, and clinical information systems adopted. As such in this section, the focus pertains to the impediments that occurred during state-wide planning.

*billion pounds? Didn't they do that at Cambridge and it was a flop, don't people die when that happens?" (Executive D)*

## 4.2 Stage 2: Princess Alexandra Hospital Implementation (2014-2017)

In 2014, the Princess Alexandra Hospital became the lead hospital of the digital transformation. The project was huge, and was much like any systems development work, involving understanding of requirements, configuration and design, interface management, implementation and testing, and change management. Due to the sheer size, scale and complexity of the project, the Princess Alexandra Hospital opted for a phased implementation approach. The first phase went live in November 2015. This involved the implementation of the electronic medical record system integrated with computerised provider order entry and preliminary decision support functionality. The purpose of this phase was to establish an electronic medical record and electronic ordering capabilities for pathology and radiology tests.

Subsequent to the roll out of the first phase, the Princess Alexandra Hospital transitioned back into project mode to integrate additional functions related to medications management. The second phase went live in March 2017, which involved integrating the intermediate solution (phase 1) with ePrescribing, anaesthetics capabilities, research functionalities and more advanced decision support. Given the high-risk nature of the second phase, it was implemented in a staggered approach over three weeks with different wards in the Princess Alexandra Hospital being implemented at different times.

At the end of the second phase, Princess Alexandra Hospital had transformed from a primarily paper-based system that supported patient treatment to a digital hospital, where the ieMR supported the collection of clinical patient information in a structured manner, close loop reporting, medication administration, ordering of laboratory tests, and advanced decision support. As a result of this transformation, Princess Alexandra Hospital was accredited as a HIMSS EMRAM Stage 6<sup>5</sup>.

Below, we report the Chief Information Officer perspective (based on a culmination of executive perspectives), an optimistic clinician perspective (based on a culmination of clinicians who held favorable views of the transformation), and a pessimistic clinician perspective (based on a culmination of clinicians who held unfavorable views of the transformation) across four salient areas of the transformation: 1) Princess Alexandra Hospital's vision, 2) clinical involvement, 3) supporting initial use, and 4) transitioning to ongoing use.

### 4.2.1 Princess Alexandra Hospital's Vision

The Princess Alexandra Hospital executive team, who were also on the executive board of Metro South HHS, were ambitious and visionary. They saw the potential value of digitally transforming patient care to improve the timely access to health services and enhance quality of patient care in a resource-constrained environment. The executives were deeply committed to the program, taking ownership and pushed the project forward where Queensland Health struggled to do so:

*"The leadership of the hospital is also very important. Because if the leader has no interest in change and does not fully comprehend the advantage of change, then that is not going to happen. Whereas we have been fortunate to have someone like [Executive] who had seen, years ago, that this change is inevitable." (Executive A)*

*"We did need someone to push that through, and ...we would have actually still been stuck if [executive] hadn't been as aggressive as he was." (Executive B)*

The digital transformation strategy at Princess Alexandra Hospital consisted of two notable aspects focusing on: (1) how the ieMR supports strategic service delivery, which reflects the current day-to-day operations of the hospital and HHS; and, (2) how the ieMR supports the future long-term goals of the hospital and HHS. This strategy and its focus on short-term and long-term objectives was a critical enabler of Queensland Health's ten-year vision. As an executive notes,

*"There is alignment, we are working ... [from] Queensland Health's ten-year vision, [which is] for Queenslanders to be amongst the healthiest people in the world. ...We will achieve it through five agendas ... [with] the critical enabler [being] digital health" (Executive G).*

<sup>5</sup> HIMSS EMRAM: Healthcare Information and Management Systems Society Electronic Medical Record Adoption Model – refer to <https://www.himssanalytics.org/emram> for more detailed information

Princess Alexandra Hospital executives all recognized the critical need for the digital transformation and implementation of the ieMR to be viewed as more than a technical project. Rather they treated the transformation as a monolithic business and technical initiative with broader ramifications. As outlined by an executive:

*“The project is more like a major capital project where you are actually thinking about, ‘I’m going to commission a new hospital’. There is this philosophical difference in my mind between an [information technology] project, like we are going to put in a new HR (Human Resource) system versus we are going to put in an electronic records system. ...The reason for that is that ...it is a monumental change. ... [That is] a fundamental difference between how this project has been managed and how previous projects have been managed. (Executive D)*

While the executive team held a largely unified view of the digital transformation, a strategic decision was made to withhold parts of the strategy from front-line clinicians. Instead, communication beyond the executive team was tailored, focusing on how the ieMR could support and change specific roles, work practices, and areas of the hospital. How the ieMR linked to the overarching hospital and services as well as to longer term goals were often neglected in these conversations. As an executive explains:

*“We have [conversations on the vision] with executives, but we don’t have the same conversations with people in the facilities. ...With very complex change ...it’s always how much do you expose to people; it’s that balance around disruption. ...Do you actually give people the whole strategic picture or do you break it down to something that is tangible, understandable, and manageable that impacts their work area? ...Due to the speed [of the transformation] we have dropped it down to something that is less complex, more focused, more tailored.” (Executive C)*

The decision to withhold parts of the strategy, while motivated in part by the rapid pace of the digital transformation at Princess Alexandra Hospital, was also motivated by the need to minimize angst of front-line clinicians, as the executive further commented:

*“You can think, I’ll be really disruptive and I’ll give everyone absolutely everything, and what you have done then is create immense distraction, and humans are very good ...around worrying about everything rather than focusing on what they need to deliver, so we have been very careful to try and minimize that rightly or wrongly” (Executive C).*

As a result of framing the strategy, operationally many front-line clinicians and heads of departments, while not pessimistic about the digital transformation, they did not share the executive’s vision. Alternatively, they focused on the implementation project rather than the broader future-focused aspects of the digital transformation strategy. Their objective was to ensure the implementation was successful and no patient harm resulted. It was their single, driving focus behind the project, as a senior doctor notes:

*“A safe and effective rollout. Just safe and effective in the first instance. And then after that, then the hope would be ...that there are efficiencies gained and that there is access to data on a really very large scale. ...The benefits of that I think we will probably be realising for a long time, but not necessarily yet.” (Senior Doctor A)*

In line with the implementation focus, a common sentiment amongst clinicians was the perception that the ieMR was merely a “tool we use to do our job” (Nurse A). They further perceived the project as “just replac(ing) paper with digital” (Doctor A). Despite this sentiment, most staff were optimistic about the ieMR as they recognized “we really have to do this because we cannot keep using paper charts” (Senior Doctor A).

Despite many clinicians perceiving the aim to be one of ‘digitization’ rather than ‘transformation’ there was also a pocket of driven, enthusiastic front-line clinicians who viewed the ieMR in keeping with the executive’s broader strategy. They perceived the ieMR would serve not only as a tool but as the foundation to transform. As described later, it was these clinicians serving in the role of clinical informaticians and adoption coaches who were pivotal to the success of the initiative, strongly identifying with the digital transformation aim; championing change, and optimising the system to revolutionise patient care.

*“[The ieMR] is going to be more of an [evolutionary] leap forward. ...In terms of the evolution of medicine and patient care, this is up there. I see this as being ...similar in magnitude to things*

*like the genesis (origin) of antibiotics and maybe anaesthesia in the 1850s. It's a big deal, I think, the capture of massive amounts of data.” (Doctor B)*

#### 4.2.2 Clinical Involvement

A safe and effective rollout required involvement from healthcare professionals. Executives early in the transformation ensured there were many opportunities for clinicians to be involved and engaged with the initiative. They felt this was imperative to the success of the initiative, as described by a senior nurse, who at times acted in an executive capacity.

*“The executives ...are not always well placed to understand the problems and what we found is having the people that experienced the problems represented on some of these committees. ...We want the information from the coalface staff and when they find something, feeding back to them that their problem is being actioned. That is really important. If you try and do this with an arrogant executive you will never pull it off. ...If you have not got an engaged workforce, you will not be able to do a successful digital implementation” (Director of Nursing C).*

Committees were established that clinicians could join. For instance, committees were formed around the core modules being implemented (e.g., medications, anaesthetics, etc.), as well as implementation and training teams. The main distinction between the two was that committees focusing on configuration had to have members from hospitals across the state (because the one instance of the system was being implemented statewide), whereas committees focusing on implementation and training were hospital-specific (because each hospital could manage its change process individually). There was strong clinician engagement in these committees, with clinical leads and clinical consultants being actively involved throughout. Senior clinicians were involved in the governance of the implementation and the go-live decision was informed by senior clinicians and taken by the executive based on the safety of the system. The importance of clinical engagement was described by a medical executive: *“The subject matter experts and ...the clinicians, the pharmacists, the medical people have provided significant leadership in the project” (Executive D)*

To digitally transform it became evident that clinical involvement required more than just the engagement of clinicians. Rather, leadership in the clinical aspects of the project began to be provided by clinical informaticians. These clinical informaticians were front-line clinicians who had upskilled to be well-versed in digital disruption and data analytics. These clinicians shared the executives' vision and deeply identified with the need to digitally transform. They acted as key influencers throughout the transformation and acted in key clinical leadership and governance roles (e.g. Chair of the 'Care Delivery' portion of the project). The clinicians' who served in these roles viewed opportunities for involvement positively:

*“In retrospect, it was actually really good and critical that (clinical informaticians) were involved in the build, because now we know the capability and we know the limitations, and we have excellent relationships with IT, which is allowing us to ...then lift all of that into quality improvement.” (Doctor C)*

This positive sentiment regarding involvement was further echoed by most frontline staff. Some administrative staff reflected on the extensiveness of *“clinical involvement with the admin staff was really well done. They were really involved, and it was a big team approach” (Admin A)*. Further, allied health professionals highlighted their involvement in *“designing the forms [where] a group of dieticians within the State [came] together...to come up with something standardised” (Allied Health A)*. Senior staff further reflected how such involvement helped foster clinicians,

*“I have not been here for very long but it's given me a lot of personal opportunities to learn and grow. ...The upside of having to be down in the detail ...is that we have identified a lot of talent, we have nurtured a lot of people, we have seen a lot of people who might be quiet innovators recognized and developed.” (Director A)*

Some nursing staff, while expressing favourably their involvement with the project and their ownership of how the iMR would be integrated into their workflow provided a more nuanced account and expressed frustration over a disconnect between technical and clinical staff. However, while expressing discontent, they also recognized the monumental effort involved in configuring, customising, and implementing the iMR. As the nurse reflected:

*“It's just between the clinical and the IT people, because the levels of frustration are – [clinicians] ask for things and then from an IT work perspective it's “no, no, we cannot do that for*

whatever reason” (Nurse C). “[IT people] probably don’t realize how it impacts on our (clinical) workflow” (Nurse D). “They don’t understand the implications from a clinical perspective. I think there is a real disconnect there across the board. ...They were trying to move a mountain and, in the end, there were a few little pebbles that were left behind, so they did pick up a lot of stuff and do as best as they could, but there were still some things that we think are so obvious [that were left behind]” (Nurse E) “such as observation forms ...for documentation of ventilated patients” (Nurse G).

Despite this, some clinicians perceived the opportunity to be involved in the project as a token gesture. They felt there was a lack of consideration and responsiveness to clinicians’ viewpoints, particularly when the clinicians raising concerns sat outside the ‘Digital Hospital’ governance structure. As a nurse explains:

*“Digital Hospital [program] has free reign and dictates a hell of a lot more than what they should. From the beginning when we first got ieMR ...we would say all of these things, and if you asked a tricky question, they would put it in the car park. ...I don’t know where the car park is, but we never came back to the car park. And any [adjustment] that they could not quite fit into the system they would say “that is an individual workflow problem [not a system problem]””* (Nurse F).

Another clinician highlighted that the initial frustration related to involvement was due to the resource-constrained nature of healthcare, particularly in surgery.

*“Most of the departments ...are clinically threadbare. There is not a massive amount of redundancy going in terms of clinical care. It’s actually very difficult for the department to justify liberating a clinician from their clinical duties to do this sort of thing ...that particularly dogged the [surgery] implementation and surgeons as well, they were really hard pressed to get any clinical engagement at all”* (Doctor B).

Despite this frustration with involvement in the first phase of the initiative, those in surgery felt more involved with the second phase and commended the clinical leadership and engagement associated particularly with the development of the anaesthetics module of the system.

*“The anaesthetics project team engaged with us early. They sought ...good strong clinical leadership and lots of clinical engagement. We had a good anaesthetics team that more or less demanded that and we had a department that were prepared to make some clinical or human resource sacrifices to enable [clinicians] ...to spend a lot of time [devoted to this project]. ...It has been a very, very well supported project on a wider level. ...It was fantastically resourced.”* (Doctor B)

### 4.2.3 Supporting Initial Use

Training and support were critical to the “safe and effective” rollout. In the first phase of the implementation largely vendor-based training was performed. Many front-line clinicians expressed dissatisfaction with the original training approach. It was considered to contain too much information, and was not personalised to the different areas of the hospital, resulting in staff anxiety. As a nurse describes:

*“The training was coming across pushed, which was causing more seasoned staff to panic. It was a huge amount of information done in one hit and terminology ...was complicated. The other problem ...and this is the biggest thing we have noticed since going live [is] the crap that was being trained was unnecessary. ...If those particular items were going to be more specific for a certain area, then maybe they needed to save that for the specific area not complicate everyone with it. ...[In implementing MARS] they have obviously learnt their lesson.”* (Nurse A)

As the above quote indicates, most of Princess Alexandra Hospital’s healthcare professionals viewed the training for phase 2 of the rollout to be more appropriate. The vendor training for the second phase was extended to place greater emphasis on simulation training. Therefore, rather than just learning how to use the system without recognition of the specific context, different wards in the hospital established simulation labs in which clinicians could learn how to incorporate the digital systems into their workflows. In doing so, they could determine how their workflows would change.

*“The first time our digital hospital system (phase 1) was implemented I enrolled to make the training module. ...[We could not] go more deeply according to the workflow because they have to make this digital hospital training State-wide. ...If anyone needs help regarding workflow*

*things then we need to discuss separately. But [now, phase 2] we made a sim (simulation) lab in each of the divisions, and we are running the sim lab according to workflows. All the nursing staff go for classroom training, that is three and a half hours as compared to last time we had eight hours. ...They come to the sim lab and then we discuss ...workflows and how you [are] going to [use the ieMR throughout the workflow].” (Nurse B)*

In addition to the training offered prior to the implementation of the ieMR, executives ensured there were multiple support structures created to assist users both immediately post go live and on an ongoing basis. A three-tier support structure was established: Tier 1 Support consisted of floor walkers, local champions, and a support hotline; Tier 2 Support included super users who had more extensive knowledge of both the systems and the workflows; and, Tier 3 Support included subject matter experts with in depth knowledge of the system and the workflows from being embedded in the project.

*“There is six and a half thousand staff, there are 800 super users. ...One in seven people is a super user. It has really been a tool for making sure there is a collection of people who are enthusiastic and own it ...and drive the project.” (Executive D)*

After implementing phase 1 of the ieMR, the need for ongoing support became apparent, in terms of: troubleshooting, and embedding the system into day-to-day work practices. To provide this support, the “adoption coach” role was created and funded as part of the ieMR project, which involved the Tier 3 subject matter experts supporting the overarching digital transformation by working with clinicians to adopt the ieMR. These adoption coaches had an interest both in digital healthcare and the opportunity it can bring, as well as system improvement, change management and implementation. Adoption coaches perceived it to be a role that offers an opportunity to learn and apply these skills across the organisation in a multitude of different ways. Adoption coaches were seen to provide credible assistance to frontline users, and their clinical background ensured they could advocate for the clinicians.

The adoption coach role has been a critical success factor to the implementation and imperative to the longevity and innovativeness of the digital hospital solution. Initially, this role, as part of the adoption services team, was designed to provide clinicians with an avenue to seek advice on how to use and personalise the ieMR to meet their needs. Post project phase at the Princess Alexandra Hospital and during the rollout of the ieMR to other sites within Metro South, it was recognised that ongoing support was required with the adoption coach roll being funded in a temporary capacity by the Clinical Informatics Department of Metro South Health. The adoption coaches played a key role in keeping clinicians informed and engaged, communicating changes and system impacts, and performing incident management. By having a clear communication strategy and coordinated incident management helped to establish trust with clinicians and executives through providing visibility, transparency, and removal of uncertainty. In addition, the adoption coaches provided insights to the optimisation team to further innovate the system:

*“Moving forward [the adoption coach team] ...will be continuing to ...problem-solve issues that come up [and]... if we cannot come up with a solution... [we] would help them ... to get those extras bits built. ...Then go back and support them when they put it into play. The role for [the] team is to be like a conduit (connect people). ...They are a group of clinicians...not an IT support process.” (Adoption Coach)*

After the roll out of the ieMR concluded across all Metro South HHS, a business case was created with adoption coaches now recognized as a permanent role.

#### 4.2.4 Transitioning to Ongoing Use

Transitioning from stabilizing the system to ensure it was “safe and effective” to being future-focused and leveraging the capabilities of the centralised data to support the strategic imperative proved challenging. Staff at all levels lamented the difficulties with extracting data from the system. In certain areas of the hospital, standard reports could not easily be created. One year after the implementation, the surgical team could not automatically produce its standard reports. In the emergency department, the data manager’s workload tripled because of additional data cleaning activities due to poor quality data being inputted into the system. This caused frustration amongst staff and limited the transformative potential of the ieMR.

*“They have not been able to actually get any data out of the system to measure ...their performance. ...We were not probably as savvy as we thought we were with well how do we get the information out of the system” (Executive B).*



*“The report side of things ...has been an unmitigated disaster, ...which is becoming a bit of an embarrassment for the board” (Senior Doctor B)*

*“We are hand generating reports everyday of things that I’m putting in like those screws, nuts, and bolts. ...We are doing a lot of extra work just to hand generate the normal information we need just to keep ourselves stocked with what we need for patients. ...The fact that [we] have to generate all that by hand ...is crap, ...[it’s] time wasting, ... [it’s] disrespect(ful). (Surgery Nurse A).*

Senior staff regularly commented on the need to transition out of the depths of project mode to consider the structures necessary for the future so the system could be more optimally used, data could be more readily extracted, and more strategic benefits attained.

*“The first [phase] positioned us well to realize you cannot do this in the trenches the whole time. ...You have to have staff in the trenches, you have got to have staff educating staff in the trenches, and you have got to have people that are above the trenches looking across the horizon to see what is coming” (Director of Nursing C)*

*“Because we have been lead hospital in ...spec’ing (identifying specifications), designing, building, testing, training, twice, we have not had cognitive space (capacity to think). ...We have been down in that sort of level of detail, and we have not had much of an opportunity to step back” (Director A)*

The executive team in recognising the importance of data to transition out of project mode and leverage the transformative potential of the ieMR sponsored the data governance committee. This committee was initially established as a special interest group consisting of both technical and clinical staff passionate about health informatics. Over time with growing recognition for the need to build data governance capacity from within, the group became more formalised and a parallel data warehouse established. This data warehouse made it possible to develop dashboards for every standard under the quality and safety framework. As a health informatics personnel reflected on the journey:

*“A group was put together to address specifically the lack of data that will be coming out. And they just worked and worked and worked until they were able to finally get out some data from the system, which was the standard nine dashboard on deteriorating (i.e., medical conditions are worsening) patients. That took a significant amount of work on the parts of our team, [clinical informaticians], and the IT department to work to understand what was required, what it should look like, feel like, do and then to actually translate that into IT speak, so that we could understand how we get that out of the system. In effect that took over 18 months from the minute they started working on saying, “We need this,” to the point where they could get data out that was remotely useable.” (Informatician A).*

In addition to the challenge of extracting data, in other areas where data had been extracted it had not been acted on appropriately. This resulted in executives expressing the necessity to develop the digital capability of hospital staff. As one executive notes,

*“It’s a learning opportunity for us. We have got all the systems and processes based on old systems and we are escalating workforce issues because somebody - whether it be vexatious or somebody reading reports, or multiple reasons.” (Executive F)*

To overcome these challenges and support clinicians and executives to use the ieMR data in an ongoing manner to inform clinical and operational improvements, the adoption coach role evolved into a ‘digital health consultant’. Digital health consultants required a broad range of skills beyond extensive ieMR knowledge, including problem solving, change management, stakeholder engagement, clinical workflow redesign, project implementation, data literacy, clinical governance, and quality improvement. With these skills digital health consultants continue to support the hospital to use the system, but now work to support changes to clinical practice through the use of data. This requires enhancements to the richness of data including accurately defining data points; fundamentally understanding how clinicians capture data in their workflow; optimizing the system; and aligning workflows.

Early success stories on leveraging data post implementation have been through the development of dashboards, which has allowed clinicians to visualise data in real-time to enhance work practices and clinical outcomes. For instance, a multidisciplinary team created a diabetes dashboard that monitored patients enabling the effective prioritization of patients, improving patient outcomes and clinician

productivity. These types of success cases are largely isolated to particular groups of individuals who see the potential of the system yet is not currently an organizational capability.

*“[There is a] need to keep showing that we are doing something valuable, and ...this is where [the dashboards] come in. ....Trying to carve out little things, that show benefit. And it’s very important that that is happening. That is not necessarily targeted at [the whole hospital]” (Senior Doctor A)*

*“We are building those roles, we are building the capacity, we are building the capability. This is the new world, and it does not arrive on day one. ...All of these are based on – and they are real live dashboards – understanding the priorities for the organization, what do we actually need in regard to that, and they all pull from the same data source. ... And you can drill down ...right down to a patient. So that dashboard back here, if I want to find out those patients, as a clinician, I can click, click, click and drill down.” (Executive C)*

Recognising the potential benefits of clinical informatics as exemplified by the above quote, the Office of the Chief Clinical Information Officer was formed. The Office of the Chief Clinical Information Officer was established primarily to: supply clinical informatics specialist resources for state-wide clinical systems; ensure maintenance of clinical content in the ieMR occurred in a timely manner; and link digital HHSs to clinical networks, eHealth Queensland, and other relevant Queensland Health divisions. In addition, due to the state-wide approach to the ieMR implementation, enhancements at a local level governed by hospital based ieMR governance needed to be considered as part of the state-wide system governance. Connecting local site-based governance to the state-wide approach was facilitated by an overarching state-wide ‘Clinical Advisory Group’, with subspecialty working groups used as needed to provide advice on specialty-area requirements. The Clinical Advisory Group included members from each digital HHS, eHealth Queensland (who have overall responsibility for the ieMR), clinical networks, and the Office of the Chief Clinical Information Officer.

### 4.3 Stage 3: Metro South HHS Rollout and the Whole of State Initiative (2017-2021)

According to the Metro South HHS executive team, to realize the benefits of the digital hospital fully the ieMR needs to be rolled out at scale to the other hospitals within the service and the state.

*“The strategy is to get the system across as many beds as we can, which is why the hospitals that we want to roll it out to all the hospitals over 100 beds.” (Executive G)*

In total, the current plan is for the ieMR to be rolled out to 27 hospitals within the state (Queensland Audit Office, 2018). Each additional digital hospital implementation was managed as a distinct project, linking to existing digital project governance mechanisms (e.g., clinical advisory group, digital hospital program committee, and project control group). After the rollout of the ieMR at the Princess Alexandra Hospital, the remainder of the hospitals within Metro South HHS went live in a phased approach. However, unlike at Princess Alexandra Hospital when the ieMR went live in two phases, within each site all capabilities went live at once. Logan Hospital went live in December 2017, followed by Beaudesert in January 2018. Redland Hospital then went live in May 2018 followed by QEII in June 2018. Other hospitals within the state have also gone live during this time, including Mackay in October 2017, Queensland Children’s Hospital in April 2018, and Townsville in September 2019. As a result, the ieMR grew from a single-site implementation at Princess Alexandra Hospital to a true multi-site system.

While Stage 3 of the digital transformation has been broadly positive (Queensland Audit Office, 2018), balancing the rollout with system enhancements was incredibly difficult and numerous challenges needed to be overcome. This resulted in vocal opponents and increased media scrutiny. News headlines became a frequent occurrence including: “Australian Medical Association of Queensland seeks halt to hospital IT upgrade, saying patient safety is being put at risk” (Bavas, 2019) and “More trouble for Queensland hospital software after state-wide issues” (Layt, 2019)

These challenges centred on whether the ieMR was fit for purpose at sites other than the Princess Alexandra Hospital. Two examples highlight these challenges: Firstly, the Princess Alexandra Hospital does not require maternity functionality, as such, when it was rolled out to other hospitals such functionality needed to be configured and comprehensively tested. Secondly, the anaesthetics module of the ieMR has been associated with wide-ranging perspectives. For instance, at the Princess Alexandra Hospital the anaesthetics component was viewed somewhat favourably but in other areas of the state it was strongly opposed. This vehement opposition was due to both functionality issues and cultural issues

as in some parts of the State staff strongly identified with the previous anaesthesia system, which had been locally developed and refined.

## 5 The Current State of the Outcomes of the Digital Transformation

Evaluating a digital transformation initiative, particularly in the healthcare domain is inherently challenging (Burton-Jones et al., 2020). Typical benefit realization management approaches are inadequate for evaluating such transformations because they are often “too linear to cater for change complexity, uncertainty, and stakeholder plurality” (Smith et al., 2020, p. 709). Solely quantitative, tangible assessments of benefits are insufficient (Reddy & Reinartz, 2017; Vial, 2019) because they fail to account for the wide-ranging and emerging impacts associated with eHealth systems (Eden et al., 2017). Consequently, as data analysts regularly stressed it proved challenging to determine the benefits obtained from the ieMR at Princess Alexandra Hospital.

*“[Benefits are] hard one to apportion ...[because] organisational efficiencies are driven by a multitude of factors; it’s not one thing. The Digital Hospital often gets questioned as not being the only driving force that would effect that overall outcome. ...I always preface anything that I do in the benefit space with that the business case was a point in time document.” (Data Analyst)*

As a result of the difficulty of assessing benefits at Princess Alexandra Hospital, it is difficult to determine whether Princess Alexandra Hospital has completely succeeded in achieving their aim of digitally transforming to support strategic service delivery and future focused goals. From an external perspective, national and international bodies recognized the success of the digital transformation, with Princess Alexandra Hospital/Metro South HHS receiving national and international awards, including: the Premier’s Award for Innovation in 2016, the HIMSS-Elsevier Digital Healthcare Award in 2017, and three International Hospital Federation Awards in 2018. As an executive notes: *“It’s brought enormous credit to the hospital. ...We are at 15 awards now which is really a credit to the people in the team they have been absolutely amazing.”* (Executive). Yet, as prefaced in Section 1, divergent views on the digital transformation have been reported, with negative media coverage and the politicizing of the digital transformation.

*“The rollout of the integrated electronic Medical Record under eHealth Queensland is the biggest [information technology] project since Labor’s (political party) Health payroll debacle a decade ago, but it is fast becoming just as bad. ...We have seen critical system failures that have caused chaos in our hospitals. ...Queenslanders deserve a world-class health system, not more Labor digital disasters.” (Australian Liberal Party Member, Bates (2019))*

On the coal face, Princess Alexandra Hospital staff hold a positive attitude towards the ieMR and are optimistic about its future potential. Immediate benefits have been realized from the conversion of paper-based records to electronic records including improvements in accessibility, legibility, and transparency of patient records. As reported by the Queensland Audit Office (2018) improvements in patient care outcomes have also been realized including a 37% decrease in infections, reduction in patient falls, and a 93% increase in the endorsement of radiology tests. The improvement in endorsing has been further detailed by a radiologist:

*“We know where everybody is at the time of the referral (time when radiology order is made), which was maybe not filled out previously. ...Our reports [now] go back to somebody, whereas before they went into the patient’s chart. ...They would not be filed unless they would be signed off by somebody. [Some] places did not check them, ...others might have checked them off, but it just had a tick. ...You never knew who actually had checked them off. ...now these results go back to that person. There is [now] a point of accountability.” (Radiologist)*

Potentially, one of the greatest benefits that has been realized has been through leveraging the data analytics capabilities, as an executive describes.

*“The diabetes dashboard ...incorporates every patient who is on insulin (medication to treat diabetes) in the Hospital, what insulin they are on, what dose they are on, when they get it, when the medication has been given late, what the blood sugar of the patient was in closest proximity to that administration of insulin. It’s enabled [the] ...diabetes liaison ward round [to take] half an hour when it used to take three and a half hours. ...A vulnerable group of patients ...are now getting unprecedented supervision, scrutiny of medication, management, pathology.*

*Compared to paper it is not even – there is nothing comparable about being a diabetic in [the hospital] today in terms of safety and quality” (Executive G)*

The opportunities associated with a single-system approach used across all sites with standardized data are still emerging, such as 1) obtaining data on particular issues across the state (e.g., patient deterioration in hospital), and 2) controlling behaviours on particular issues across the state (e.g., common alerts and protocols for patient deterioration in hospital). However, over time there has been increasing angst as to whether the transformative potential of the ieMR and the data contained within is being leveraged to its fullest extent. To better harness the potential of the ieMR, the HHSs have had to evolve into a fully digital-capable service, the same was required for Queensland Health departments and services. To facilitate this, the Digital Health Improvement Network, which is a State-wide network has been established as “*advisory clinical body ...that provides, clear coordinated, and authoritative clinical advice and leadership to the [State’s] digital health ecosystem.*” (Queensland Government, 2020). Likewise, the Office of the Chief Clinical Information Officer bridges the clinical, technical, regulatory, and operational gap between Queensland Health departments, eHealth Queensland and digital HHSs by providing expert clinical informatics support.

Aside from these initial benefits and emerging opportunities, there have also been some mixed results, where some perceive the ieMR to be beneficial whereas others perceive it to be negative. For instance, in some instances the system improves clinical judgments through providing alerts, however others perceive that it might make clinicians reliant on those alerts.

*“[The ieMR] will flag up if you have popped the [observations] in and something is not within the normal limits...I think that is really useful. Especially for junior staff...I’m just hoping that does not take away people’s clinical judgement.” (Nurse)*

In addition, some suboptimal work practices have emerged including paper persistence and inappropriate work arounds, which can cause information quality concerns.

*“We have found cut and pasting options are used in a lot of instances. ...People are cutting and pasting complex medication orders and the cut and paste actually does not work. You know, it’s far too complex. A cut and paste on a Word document is very simple but a big order that has a lot of background information does not function the same way.” (Radiologist)*

There have been concerns raised surrounding the cost of the implementation project. In accordance with Queensland Audit Office (2018) \$431.6 million AUD has been spent on the digital transformation thus far and it is expected that a total of \$869.7 million AUD will be required. However, the true cost of the project is unknown as some of the hospitals lack the required project management tools to track their spending.

Going forth there is a need to continue improving how these systems are used and develop the organizational capability to leverage the data in the system more effectively so large-scale benefits are obtained. This will help over time to minimize the cost overruns experienced in the state-wide rollout.

## 6 Ongoing Tensions

While the digital transformation initiative at Princess Alexandra Hospital has received some initial positive outcomes, as discussed in Section 5, the state-wide approach, with a single system, on a single database instance across all hospitals in the state has the potential for a wide range of benefits, including improved standardization, transparency across sites, and workforce mobility. Yet, the number of hospitals involved, and the quick succession of implementations caused tension between the sites. Two critical tensions were: (1) tension in the build process; and (2) tension in providing support while optimizing the system.

In terms of the first tension, it was difficult to identify the best way to configure the system to suit all hospitals and professional groups. At Princess Alexandra Hospital two strategies were performed to improve fit between the system and the hospital. Firstly, as part of the build process undertaken at Princess Alexandra Hospital, the core approach was to, where possible, build the current workflows of respective units and specialties into the ieMR. Secondly, analyses were performed to ensure Princess Alexandra Hospital’s current models of care are reflective of best practice as informed by the latest evidence. Where deficiencies existed, it was identified whether changes could be built into the system to potentially improve practice. Despite these extensive efforts to improve alignment challenges remain as while all hospitals treat patients they do so in different ways. Different hospitals also offer different medical services, for instance Princess Alexandra Hospital does not require pediatrics functionality as it is not

offered by the hospital, whereas Logan Hospital does. In addition, Beaudesert Hospital is a regional, smaller hospital and typically does not cater for the needs of critical patients as that complex cohort gets transferred to Logan Hospital or to Princess Alexandra Hospital. Each site commencing implementation inevitably requires local system customization based on existing/ non-modifiable workflows. The final key difference observed is that different hospitals had different systems prior to going live that are more tailored to their needs than the ieMR as such different levels of resistance can be experienced. These tensions are summarized by a director of nursing:

*“The frustration is that it is a State-wide platform and ...at many of those forums where we have tried to negotiate and work with, massage, whatever you want to call it, other facilities. I do not like talking about paediatrics and maternity stuff that I am not too interested in operationally here but working with smaller hospitals that have a different way of doing things in the existing system, the old system, that they want duplicated in the new system. That is a frustration with going forward, [and] is going to have to be managed into the future, as more sites come on. ...It’s very hard to design something that suits everybody in a hospital, let alone everybody in a state. And we really grappled with that.” (Director of Nursing C)*

In terms of the second tension, there were concerns related to the ongoing rollout of the ieMR solution. This is because staff at Princess Alexandra Hospital were required to facilitate the roll out at other sites to impart their lessons learned. However, this meant that optimization efforts at Princess Alexandra Hospital had to be put on hold while these sites were going live. Moreover, sites who were new to ieMR were reluctant to continually change the system given the effort to onboard and build confidence with their clinical staff. Concerns were further raised that other hospitals would not have the resources required to devote to ongoing optimization efforts. This tension is described below:

*“I think the tension between making sure that it’s fully bedded down and there are good processes for the continuing training, education, up skilling, problem solving and development, and... we worry it’s just going to get really pushed aside. ... You are implemented, and now we have moved on to the next site. ...We face that tension with the first build where they just kept saying business as usual, business as usual. It’s quite distressing to clinicians because the interpretation of that from a clinician’s standpoint is we are withdrawing any help. It’s now you are on your own. And that is the feeling that people are starting to have now, particularly with the pressure to support Logan. And Logan will need a lot of support because they are trying to do what we did in two goes, all in one, which is a big ask and they really do need help. But the fear is that there is just a great determination to put down the shutters and pull everybody out of here to go and do the next thing because that is where the interest is, and perhaps people will not be so interested in what is left behind. ...There is a risk of that. The excitement is all in what is new and what is rolling out and what are we doing, not in necessarily mopping up what is left and really embedding it and having it solid and well supported and all of that.” (Senior Doctor A)*

Tensions have always existed between the different hospitals in Metro South HHS and in the State. The state-wide approach to the ieMR has brought these tensions to the surface and further amplified them. As the following express:

*“You know, patient outcomes from a nurse sensitive point of view, should be the same in every organization in the one health system. Well, it should be everywhere, or it should be similar. ...Now the culture probably takes over, ‘Because PA (Princess Alexandra Hospital) does this, we are not going to do this here, we are different.’” (Executive F)*

As a result of these two critical tensions, the list of enhancements required has grown to a level clearly unsustainable within existing resources. Managing this list is challenging due to the difficulty in prioritizing each request alongside the next in terms of value (or risk mitigated) and achievability.

## 7 Conclusion

Reflecting on the journey, the Chief Information Officer knew that in comparison with healthcare digital transformation initiatives elsewhere, the implementation of the ieMR at Princess Alexandra Hospital and more broadly the Metro South HHS had been quite successful. Despite initial positive outcomes and national and international awards, a difficult journey lay ahead, and political groups and news media could be unforgiving if real or apparent errors occurred. Most importantly, the Chief Information Officer knew he

and the other leaders needed to find a way to balance the tensions between the different sites and ongoing optimization efforts as the ieMR rollout continues.

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