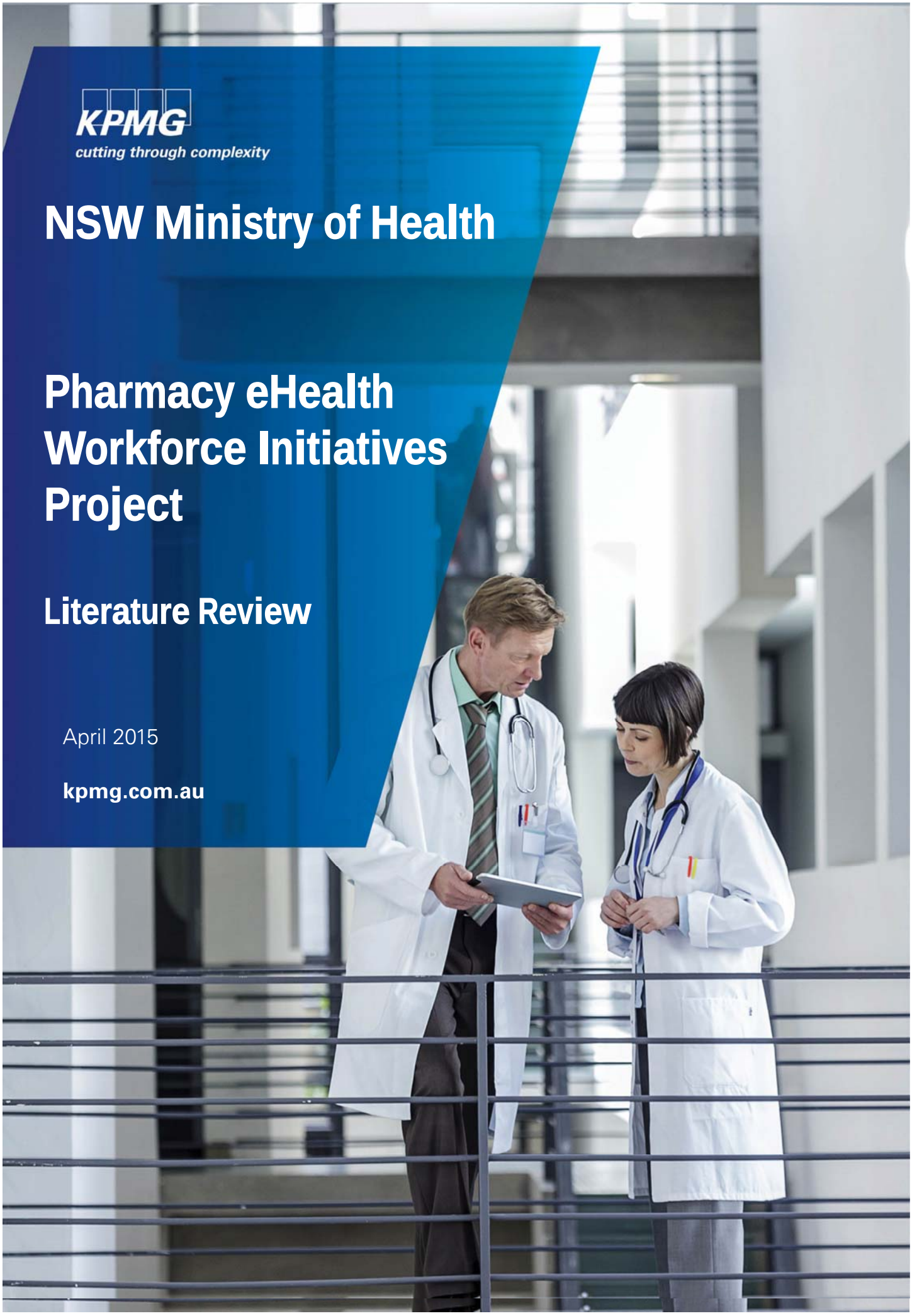

KPMG
cutting through complexity

NSW Ministry of Health

Pharmacy eHealth Workforce Initiatives Project

Literature Review

April 2015

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Inherent Limitations

This literature review has been prepared as outlined in the Scope Section. The services provided in connection with this engagement comprise an advisory engagement which is not subject to Australian Auditing Standards or Australian Standards on Review or Assurance Engagements, and consequently no opinions or conclusions intended to convey assurance have been expressed.

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KPMG have indicated within this report the sources of the information provided. We have not sought to independently verify those sources unless otherwise noted within the literature review.

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Section One: Introduction

Introduction

KPMG has been engaged by the NSW Ministry of Health to undertake research into workforce planning models pertaining to the upcoming implementation of the Electronic Medication Management (EMM) Reform Program. The scope of this workforce analysis includes horizon scanning (a literature review) to identify current learnings from the implementation of similar programs within Australia and overseas and to identify emerging issues that may impact upon the implementation of the eHealth initiatives.

The purpose of this literature review is to consider:

- national and international grey and academic literature on the implementation of Electronic Medication Management (EMM) programs;
- trends in eHealth with a specific focus on EMM; and
- impacts of EMM implementation on the pharmacy workforce and on workflows in hospital pharmacy settings.

While reading this literature review, it is pertinent to note that:

- literature varies in terminology, and the term 'EMM' is used to refer to the electronic medication management process in its entirety or to components of the EMM continuum; and
- the medication management continuum necessarily includes a range of clinical and professional staff. Wherever possible this review maintained a focus on pharmacy staff although examples of EMM impacts on nursing staff or clinicians are also highlighted to exemplify the linkages in the EMM continuum, and where impacts have flow-on effects.

1.1 Scope of the Literature Review

KPMG's approach to undertaking this literature review involved three key steps:

1) Defining the scope – in this case, the scope of the literature review was first defined with NSW Health based on their needs for this project. It was agreed that the scope would be limited to hospital pharmacy workforce development, trends in eHealth (specifically EMM) and the impacts to workforce and workflow that result from EMM implementation. The review also examined any available evaluations and workforce initiatives relevant to hospital pharmacy workforce planning.
2) Searching academic literature – the search focused on specific search terms as agreed with NSW Health. These are outlined in section 1.2: Methodology.
3) Reviewing grey literature – KPMG reviewed relevant government reports and reports from accredited professional bodies both within Australia and overseas, primarily in the United States and the United Kingdom, with some exploration more broadly across Europe.

1.2 Methodology

The search of academic literature focused on specific search terms including 'Electronic medication management'; 'EMM'; 'EMR'; 'pharmacy + eHealth'; 'pharmacy + workforce'; 'eHealth + workforce'; 'EMM + workflow'; 'electronic medication management + workflow'.

Our health workforce literature scanning used the EBSCO, Proquest Health, Informit, and Medical Complete databases. In addition the Social Sciences Citation Index (SSCI) database[1] was used to find where quality articles have been referenced in other literature.

The scanning included Australian health workforce key industry research (such as that undertaken by the Australian Commission on Safety and Quality in Healthcare), state and territory research (such as the Gartner Report from Victoria) and research undertaken internationally (such as the NHS). Evaluations, critiques, inquiries and reports from reputable sources including health professional associations (such as the Australian Pharmaceutical Advisory Council) were also included.

1.3 Strengths and limitations of the review

Over sixty articles have been analysed, and approximately fifty included in this literature review. However the literature search revealed that there is a greater breadth and depth of published literature in some areas, and very little in others.

For example, a large number of articles focused upon the experience of nursing staff and clinicians during the implementation of EMM (either end-to-end or components thereof), and a number of sources were identified addressing the impact of EMM on medication errors. However, there was a dearth of literature on workforce impacts of EMM implementation, and even less when the search was limited to hospital pharmacy staff.

Section Two: Overview of EMM in NSW

Overview of EMM in NSW

NSW Health is committed to the implementation of Electronic Medication Management (EMM) systems, as a component of a wider NSW Government reform agenda for ICT programs over the next decade as outlined in the *Blueprint for eHealth*.[2] Hospital EMM systems enable prescribing, supply and administration of medicines to be completed electronically (wholly or in part), potentially covering the entire hospital medication cycle including prescribing by doctors, review and dispensing of medication orders by pharmacists, and administration of medications by nurses.[3] At the centre of this commitment is patient safety – a reduction of likelihood of patient harm through medication errors and adverse events, which will ultimately improve the patient journey.

Electronic Medications Management (EMM) refers to the use of Information Communication Technology to support and enable the processes involved in the medication management cycle. While there are a range of EMM solutions on the market, the functionality of systems typically spans:

- medications history recording;
- medications review and reconciliation;
- allergies and adverse drug reaction history and alerts;
- ePrescribing;
- medications formulary, standardised medications catalogue, order-sets and clinical decision support;
- electronic medication ordering;
- dispensing;
- electronic administration records;
- access to shared medication lists from local and national eHealth records
- electronic claiming; and
- eDischarge summaries.[4]

The implementation of EMM has strong endorsement both in Australia and internationally including support from the Australian Medical Association, the Pharmacy Society of Australia, the Pharmacy Guild of Australia and the National Health Hospitals Reform Commission.[12]

2.1 Progress

To date, Electronic Medical Record (EMR) systems have been implemented across NSW and are now used in a range of clinical settings, including:

- Emergency Departments and Operating Theatres, to track and monitor the clinical status of patients;
- busy hospital wards, where clinicians use the EMRs to order blood tests and x-rays, and to review the test results on-line (as well as having the ability to view digital images from anywhere in a metropolitan or rural hospital); and
- electronic discharge summaries of a patient's hospital visit to their general practitioner.[5]

Continual enhancements to the EMR system have enabled enhanced functionality such as clinical documentation, customised speciality views of patient information and improved system performance. Over time, the EMR system will contain complete records of a patient's medical information including hospital admissions, attendances at outpatient clinics, and in some cases community health records, and will be accessible in one shareable electronic record to all authorised people taking care of the patient.

Recognising that the use of medicines is "the most common and complex therapeutic intervention in hospitals, and has the greatest potential to cause harm",[5] the introduction of EMM is the next phase of 'technologisation' of the health system in NSW. NSW Health intends to introduce EMM across the entire medication management process, which would include barcode scanning and packing of medicines.

Implementation of EMM in NSW hospitals is gaining momentum with significant progress made in the NSW pharmacy supply chain with systems and data standardisation. The NSW Health EMM Program includes a commitment to implementing EMM systems in 28 hospitals over the next 3 years. It is understood that implementation has already occurred at one site, whilst another two are preparing to implement.

The introduction of EMM (including the wider eHealth initiatives) in the NSW public health system provides the opportunity to realise a number of benefits to clinical outcomes, the key benefit being the minimisation of medication errors. If implemented successfully, other key benefits are expected to include improved clinical information sharing; minimised transcription errors; reduced duplication, waste and system wide inefficiency; prevention of the misalignment of records; and standardised, legible and complete orders. This is not only desirable, but essential in an environment of increased complexity with respect to prescribing and administering medication as well as in an increasingly financially-constrained reform environment.

2.2 NSW EMM program components

The NSW Health EMM Program includes a range of eHealth initiatives including updates to iPharmacy Software; the Medicines Reconciliation initiative; barcode scanning for the safe distribution of medicines in hospitals; inpatient EMM including the introduction of electronic approvals and script signatures; discharge and outpatient prescribing; antimicrobial stewardship; and Medicines Database Management.

To realise the full benefits of EMM, and minimise the harm that can occur within a poorly implemented EMM system, there are a range of matters that require consideration. One of the most critical is the impact of the change on workforce. Staff will experience a range of challenges during the adoption of, and adaptation to, the new system. They will experience changes in workflow and will be required to undertake initial and ongoing training and development to understand and utilise the new EMM system. There may be patches of resistance, and if the process is poorly managed these could be widespread. Change management support has been shown to be crucial through the transition period to the

new system, overcoming concerns in moving from paper based to electronic systems, adequately planning for different scenarios and settings, planning for the interaction with other systems and processes and adequately planning for the different users of the system.

These and other issues are discussed in this review, with a focus on workforce and workflows impacts within a clinical pharmacy EMM implementation setting.

Section Three: Learnings from EMM implementation projects

Learnings from EMM implementation projects

At a basic level, EMM systems are designed to support the medication management continuum, from prescription to administration of medicine to patients. An EMM system has the potential to provide a range of benefits for healthcare professionals and patients alike, but the benefits are diminished and the safety and quality of care threatened, if the EMM system is inadequately designed, poorly implemented or under resourced.[6]

EMM also has the potential to reduce costs through creating efficiencies within the health system, although it is well recognised that full benefits of these technologies (including cost reduction benefits) are realised over time, not initially.[6,7] The speed of implementation is dependent upon different conditions including technical, organisational and political demands.[8] Implementation of new systems can be time-consuming for system users, which may cause frustration and irritation during the roll out of the system. Increased efficiencies in process that result in time savings for clinical staff may not be realised until full implementation of the EMM system.

This section discusses learnings from EMM implementation projects worldwide, including from EMM implementation projects within Australia.

3.1 International findings

Considerable investments are being made worldwide in electronic clinical applications designed to improve patient safety as well as business processes. National electronic health projects have been launched in the United States, Canada, New Zealand, United Kingdom and throughout the European Union (EU).

A large-scale pilot project in Europe includes 23 EU member states and other European countries, and aims to bring forward cross-border eHealth interoperability by exploring patient summary and ePrescription services at the pan-European level.[9]

There is also cross-Atlantic collaboration underway between the European Commission's Directorate General for Communications Networks, Content and Technology (DG CONNECT) and the United States Department of Health and Human Services (DHHS), who have agreed on a roadmap to strengthen transatlantic cooperation in eHealth and Health information technologies (IT). A Memoranda of Understanding between the two entities aims to support population health (ageing, healthcare and innovation) through "effective universal provision of electronic prescribing and clinical decision support, as well as to enhance the capacity and use of eHealth/health IT to support and advance other critically important health related activities such as clinical research."[10]

EMM projects are in different stages of implementation in clinical settings around the world, driven primarily by the need to reduce harm through medication errors. Other drivers also exist, for example healthcare providers in the United States (US) and the United Kingdom (UK) are concerned with streamlining healthcare activities for cost-effectiveness and achieving outcomes targets (in addition to patient safety). Notably the push to control medication costs in the US has led to widespread workforce reductions at hospitals

throughout the country[11], thereby placing increased pressure on delivering patient-centred care with limited resources.

Other benefits of EMM are widely researched and well-published.[4,5,7,12,18,21] At a high level these include:

- a reduction in medication errors;
- a reduction in variance in prescribing practice;
- improved legibility, completeness and availability of medicine orders;
- improved communication with patients about their medication;
- improved decision-making facilitated by information resources; and
- more efficient and effective interactions among the care team, including pharmacy.

There are important learnings that can be harnessed from those who have implemented EMM to ensure greater likelihood of successful implementation of EMM in NSW. International insights following EMM implementation (focusing on the pharmacy workforce) include[8, 12]:

- Ensuring a **consumer-focused approach to EMM implementation** – it is widely reported that a patient-centric approach results in higher clinical quality and efficiency, a safer patient environment, greater employee engagement, and improved financial results. The use of EMM has the potential to facilitate the patient experience through reducing the potential for error and adverse effects to facilitating a more seamless and secure pathway through the care continuum.
- Understanding the **importance of strong governance, executive leadership and sponsorship** – a large project such as an EMM implementation requires strong ongoing leadership. This should be considered a key requirement for an EMM implementation project. However pharmacists as experts in the safe use of medicines are key stakeholders and decision makers and should be considered for key leadership roles in the EMM implementation project[12], and should assume a principal role on the project board.[6]
- Acknowledging the **criticality of engagement across the hospital workforce,** including **strong change management support** and the **use of change champions** to get stakeholders 'on board' and to accommodate different interpretations of EMM practice. Organisations that engaged end-users during the planning and development stage had more success implementing Electronic Medical Record (EMR) systems, and achieved greater buy-in and acceptance of the systems. Nurses were found to be strong candidates for leadership and engagement roles, or 'change champions', particularly in the planning phase of implementation given their central role at the front line of care and established relationships with pharmacies, and may be suitable champions for the EMM. It was found that staff at all levels should be taken along on the journey to raise awareness of the project and to generate buy-in. The literature suggests awareness through regular communication, setting realistic goals and monitoring progress through measurable metrics. For example as the U.S. Veterans Administration moved from small-scale to full-scale implementation of an IT system within a Cardiology unit, they learned that sites that had identified and engaged a champion on site were able to implement the system more quickly.[8]

- **Ensuring sufficient resourcing for the life of the project** – EMM implementation is a resource intensive endeavour. The success of the project, if it is insufficiently resourced (with both financial and human resources) is at stake. Adequate resources and strong governance mechanisms should be in place and used from the start of the EMM implementation.[4]
- It **is critical to engage all key system users early in the project** (in particular during project scoping and process mapping) to ensure that the impacts of the EMM system on non-clinical care providers aren't underestimated.[6] Early involvement of diverse stakeholders also assists with communicating project rationale, and to determine realistic resource estimates and time commitments by key users which in time will facilitate project implementation and minimise conflicting work and project priorities.[6] This is particularly true for the pharmacy workforce which bears a disproportionate workload associated with the implementation and ongoing operations of an EMM system.[12]
- Providing **ongoing training for staff** across the project – this includes training across all professional groups involved throughout the implementation process, as well as ongoing training to keep key users up to date on changes and upgrades to the system. The pharmacy department can identify areas and applications of best practice which can be used to provide training and develop training guides.
- **Progressive implementation** – EMM systems are complex in nature, particularly end-to-end EMM systems. Setting realistic timeframes is imperative. A continuous rollout builds confidence in the system and allows for identification of problems.[13] The literature shows a trade-off between the speed and efficiency of implementation and the level of acceptance by staff – the more progressive the implementation, the more likely staff are to accept and use the new technology. [8] A 'big bang' approach has been associated with the greatest losses in productivity whereas a hybrid approach, starting with limited introduction and then followed by a complete roll-out the following year, were associated with significant productivity gains.[8]
- Planning for **workflow impacts** - A workflow process mapping exercise should occur early and be monitored regularly throughout the project. The workflow process mapping exercise must:
    -recognise impacts for all users of the system (nursing staff, medical staff, pharmacy staff and other allied health);
    -take into account how current practices and interactions between users may be impacted;
    - account for differences for intensive care and high dependency areas; and
    - consider the impacts and interaction of the EMM system with other systems and processes, including the EMR.

Workflow impacts of EMM implementation on staff are discussed in greater detail in section 4 of this review.

3.2 Australian findings

Despite its size and complexity, the Australian health sector has invested considerably less than other sectors (e.g. telecommunications and financial services) on information technology over the past 20 to 30 years, and as a result the progress of health IT implementation across Australia and associated service quality, safety and efficiency gains lags behind that of comparable industries. Notwithstanding this, investment in eHealth is now increasing and eHealth initiatives widespread, although at various stages of implementation across Australia.

3.2.1 National context

National coordination and collaboration in e-health is guided by a National eHealth Strategy that reinforces the existing collaboration of Commonwealth, State and Territory Governments on the core foundations of a national e-health system and identifies priority areas where this can be progressively extended to support health reform in Australia.[15] The role of the Commonwealth Government in EMM implementation is to encourage adoption of electronic health systems, to provide a common set of priorities for the states and territories and to standardise products and terminology. The Standing Council on Health, under the auspices of the Council of Australian Governments (COAG), has responsibility for e-health and information management (amongst several diverse areas of health care reform).[16]

The Australian Government's regulatory roles include overseeing the safety and quality of pharmaceutical and therapeutic goods and appliances. The Australian Commission on Safety and Quality in health care developed Medication Safety Standards which are guided by the following set of criteria:

- Governance and systems for medication and safety;
- Documentation of patient information;
- Medication management processes;
- Continuity of medication management; and
- Communicating with patients and carers.

Solutions to prevent medication errors are contained within these criteria, in standardisation and systematisation of medication management processes, which include the use of technology to support information recording and transfer and providing better access to patient information and clinical decision support at the point of care.[17]

3.2.2 State context

Adoption of EMM on a state-by-state basis is currently occurring in silos. For example, New South Wales FirstNet electronic medical record system traces patient care in the states' hospital system whilst the South Australian Government's is working on electronic master patient indexes, patient administration systems and secure messaging platforms.[18]

States and territories have approached EMM systems in various ways, from considering EMM as part of a state-wide e-Health strategy (Victoria, South Australia,

Queensland, New South Wales, Western Australia), to trialling EMM or part EMM systems (South Australia, Northern Territory, Tasmania and the Australian Capital Territory). Automated dispensing systems have been implemented across Australia and electronic systems for medication reconciliation have been implemented by Queensland Health (such as the Electronic Liaison Medication System), and at Launceston General Hospital in Tasmania.[12,25] Medication reconciliation systems have been implemented in numerous hospitals where EMM systems are not yet in place, and are being considered by some hospital project teams as a precursor to full EMM implementation.[12]

The NSW ICT Strategic Plan 2006-2011 was the basis for significant technology led investments in clinical management, corporate efficiencies and smart infrastructure, and remains relevant as its core initiatives continue to be rolled out.[2] In 2011 a whole of Health approach to eHealth was adopted and, following a broad review undertaken by the eHealth Committee with advice from KPMG, an eHealth Blueprint for eHealth implementation was developed. This document announces the eHealth governance arrangements, vision and direction. A concept of operations articulates the vision for NSW Health and EMM and includes identifies challenges and strategies for building EMM capability and capacity.

3.2.3 Private sector

There are other smaller providers who are entering the electronic health market, such as Uniting Care. St. Stephen's hospital in Hervey Bay has rolled out 'Australia's first' fully-integrated digital hospital[19] which includes 96 inpatient beds. The end-to-end paperless system includes a closed-loop EMM system that utilises unit dose packaging with bar coding and automated dispensing cabinets (ADCs) to minimise the chances of selection error.

3.2.4 Identified risks and challenges

Similar challenges have befallen Australian health care providers implementing EMM systems to those implementing similar systems internationally. In Australia, the causes of unsuccessful EMM projects have been attributed to one or more of the following[12,13,20]:

- lack of executive level sponsorship;
- lack of clinical 'champions';
- insufficient planning and resources;
- insufficient funding or cutting corners to meet budget;
- technical—lack of devices at point-of-care;
- human—failure to engage additional personnel for user support sustainability, audit and enhancement;
- failure to adequately involve end-users;
- failure to improve manual systems prior to computerisation;
- inadequate change management;
- failure to perform implementation and post-implementation; and
- assessment and remediation.

A range of other key considerations found in the Australian context, and detailed below, include:

- Workflow mapping that reflects the medication management continuum and patient centred care;
- the impact of EMM on the required capabilities, education and training, scope of practice and credentialing of the pharmacy workforce (and any other impacted workforces);
- Technical functionality of EMM and impact on workflow;
- The specialist needs of services and high dependency units- including intensive care and emergency departments, children's and mental health services;
- Interaction with other systems- these include systems for diagnostic and pathology results; allergy and adverse drug reactions records; medication histories on admission; and discharge prescriptions and summaries.

3.2.5 Medication Management Continuum

The Australian Commission on Safety and Quality in Healthcare advises that careful consideration should be given to the medication management continuum in EMM implementation. This will require an end-to-end process mapping exercise that clearly indicates what will occur on the EMM continuum within each service delivery area.[12]

In the NSW EMM context, the inpatient medication management process is most relevant, which includes considerations of the following processes:[12]

- Reconciling on admission;
- Prescribing;
- Reconciling medicines ordered;
- Documenting the administration of medication and clinically reviewing the effectiveness/adequacy of the medicines;
- Prescribing discharge medicines; and
- Reconciling medicines on discharge.

The medication management continuum reflects the Australian Pharmaceutical Advisory Council's *Guiding principles to achieve continuity in medication management,* which must be adhered to by all clinicians involved in medication management to reduce harm and risk to consumers.

3.2.6 Capabilities, education and training, scope of practice and credentialing

The impact of EMM on the pharmacy workforce need to be considered in terms of the future capabilities required of the workforce, and any changes this has on education and training, scope of practice and credentialing. This needs to be considered both for Pharmacists (registered under the National Registration and Accreditation Scheme and governed by the Pharmacy Board of Australia), and the Pharmacy Assistant and Pharmacy Technician workforces.

In addition consideration needs to be given to ensuring that quality and safety in clinical practice is always supported through any change process and that Australian

professional standards are upheld. This includes ensuring compliance with any guidelines released by the Pharmacy Board of Australia (including the *'Guidelines for the dispensing of medicines'*), professional practice standards, state and federal legislation regarding medicines (including schedule 3 medications), and the Australian Pharmaceutical Advisory Council's guidelines (including the *'Guiding principles to achieve continuity in medication management'*).[40,41]

3.2.7 Technical functionality

While outside the scope of this review, it is noted that key considerations of EMM functionality including wireless bedside or point of care access to EMM, robust technical infrastructure and business continuity plans in the event that EMM becomes unavailable, are flagged as critical in planning and implementation of EMM, and may impact on workflows.[12]

3.2.8 Specialist considerations

Workflow impacts and process mapping should take into account differences that may be required for intensive care/ high dependency areas such as the Emergency Department. In the Australian context, Emergency Departments have sometimes been excluded from the initial rollout, or it has been the first area considered in implementation. If it is included, the decision of whether to include only those who will become inpatients, or the whole ED, has been found to be a critical scope question that needs to be clarified in order to ensure the workflows and EMM implementation are effectively supported. [12]

Other areas of high dependency care have been considered in some of the modules included in the ICT systems, with the Victorian Audit report finding that ICT systems should consider specialist needs in cardiology, intensive care and oncology, and specialised clinical care processes including managing dialysis patients or transplant surgery patients. [21] The Australian Commission on Safety and Quality in Health Care suggests EMM needs to cover four key specialty areas- infusions and fluid balance, chemotherapy, renal dialysis and paediatrics. [3] While not specifically identified in the literature, it is expected that specialist considerations may be appropriate for mental health facilities and services.

It is noted that the EMR system selected for the Royal Children's Hospital in Melbourne has been implemented in other children's hospitals in the United States and is believed to be tailored to meet these specialist needs. It should also be noted that EMM is already being rolled out at some specialty sites within NSW, including the Concord Centre for Mental Health and planned implementation at the Children's Hospital at Westmead.

3.2.9 Interaction with other systems

Workflow process mapping should consider the impacts and interaction of the EMM system with other ICT systems. The Australian Commission on Safety and Quality in Healthcare's *Electronic Medication Management System: A Guide to Safe Implementation* flags that of particular importance are consideration of systems interactions for diagnostic and pathology orders and results; adverse drug reactions and

allergies records; medication histories on admission; and discharge prescriptions and summaries.[12] It should also be integrated with pharmacy dispensing systems. This is to ensure that the information that is needed to make clinical and medications decisions is available and where possible integrated with the EMM solution.

3.2.10 Patient safety and medication errors

The most commonly cited benefit of EMM is the reduction in potential errors and adverse events, the majority of which are classed as preventable.[27, 31] Medication errors can range from relatively minor to life-threatening, and can occur at any stage along the medication management continuum. Thus, the introduction of systems and processes which can reduce (or in the best-case, eliminate) errors is not only appealing, but imperative.

A systemic review of the literature in 2009 identified 12 studies that suggest computerised order entry (CPOE) reduces prescribing errors, with many reporting a relative reduction in errors of over 85%.[44,45,46,47] While there was an overall reduction in errors it is important to note that many new errors were created, particularly in duplication of prescriptions and drug monitoring errors (including failure to discontinue drugs). [48.] A further systematic review in 2008 had consistent findings, with 23 of the 25 studies showing a significant relative risk reduction as a result of electronic prescribing.[49]

In Australia, literature also shows that the introduction of new technologies has introduced different types of errors, in particular in the early stages of EMM implementation. A post-EMM implementation retrospective analysis of 359 incident reports across two hospital sites in urban Melbourne found that the vast majority of medication errors occur at the nurse administration (71.5%) and prescription (16.4%) stages of delivery, with notably few medication errors reported by pharmacists, and only at the non-EMM site (n=1, 0.4%). [28] An analysis of the impact of two e-prescribing systems in two Australian teaching hospitals found a statistically significant reduction in total prescribing error rates by over 55%. [31]

A study in the United Kingdom also found that introducing an electronic prescribing system gives rise to new types of errors and risks to patient safety. Effective implementation therefore requires an awareness of these errors- which in the study were found to be sociotechnical incidents, including training of new users; missing electronic signatures; an inability to effectively use the interfaces designed; and limitations on prescribing privileges in the system. Such errors can be addressed by designing out and testing the new system, ensuring effective training and revising clinical protocols if needed.39

It is however, important to note that research also identifies that electronic medications management systems introduce new errors. A study seeking to identify, quantify and analyse new types of prescribing errors associated with electronic prescribing practices in Australia found system related errors were frequent, comprising 42% of all prescribing errors at the two hospitals that were analysed. The most frequent cause of this was error in selection of information in the system. It is however important to note that at both hospitals, the systems prevented more prescribing errors than they created.[53]

Auditor General's Report – Clinical ICT systems in the Victorian public sector [21]

In October 2013, the Victorian Auditor General released an audit report outlining key risks and issues found following the planned roll-out of clinical ICT systems to nineteen public health services in Victoria, where ultimately the Department of Health significantly exceeded the initial budget and only ultimately delivered the HealthSMART clinical ICT system to four health services. This report highlights many of the risks and issues noted both internationally and in the Australian context that need to be considered for EMM.

The key findings of the audit report included:

- A **significant cost blow out**. As at October 2013, the total cost was $145.3 million, costing $87 million more than the original approved budget, and delivering a significantly reduced scope;
- A **significant underestimation of the required project scope, timelines, workflow redesign and change management** required;
- A solution that was **not well suited to the specialist needs** of some hospitals. It is noted later in the report that ICT systems should include specialist modules in cardiology, intensive care and oncology, and should be able to support specialised clinical care processes including managing dialysis patients or transplant surgery patients;
- The introduction of **electronic medication ordering and management** was the most difficult and **complex component** of the ICT system;
- A failure to achieve the planned benefit of delivering shared patient data across Victoria's public hospitals. Now with both HealthSMART and non HealthSMART ICT solutions there is **no 'interoperability';**
- **Potential clinical risks** needing to be addressed **following the implementation of EMM** in the key sites – these related to a discontinuation of patient treatment information, confusion around ordering and dispensing of complex prescriptions, and system printed prescriptions being hand-amended; and
- A key recommendation to **expedite the mandatory and ongoing training** for clinicians in the ICT systems, prioritising training for the prescribing and administration of medicines.

It should also be noted that the Audit Report also found that some key benefits had occurred as a result of the implementation of the HealthSMART system, these were allowing clinicians simultaneous access to electronic patient data, providing the ability to securely forward patient discharge summaries to general practitioners and the development of the Australian Medication Terminology Catalogue. It also noted that benefits realisation was, at the time of the audit, not being monitored or reviewed by the Department of Health, which was at least partially due to funding constraints.

Section Four: Implications for the pharmacy workforce

Implications for the pharmacy workforce

As has been noted previously, there was relatively little literature available on the impact of EMM programs on the workforce models and workflows for the pharmacy workforce. In addition there is very little published both internationally and in an Australian context on best practice workforce models for the hospital pharmacy workforce. The limited findings, learnings and evidence in this area suggest that while the implications for the pharmacy workforce are difficult to predict, it is an area in which NSW has the opportunity to lead and drive best practice in Australia.

4.1 The Australian pharmacy workforce

In March 2014 Health Workforce Australia released a report which provided a current snapshot of Pharmacists in Australia which is important in understanding the current context, prior to EMM. Key findings included (based on 2012 data)[42]:

- There were 21,331 registered Pharmacists;
- Of these, 26% worked in the public sector, and 18% worked in hospital settings;
- The majority (31%) worked in New South Wales, however with the exception of the Northern Territory, New South Wales had the lowest number of Pharmacists per 100,000 in the population; and
- The Pharmacy workforce remains concentrated in major cities with:
  - -Major cities having 101.6 Pharmacists per 100,000 in the population;
  - -Inner regional locations having 79.3 Pharmacists per 100,000 in the population;
  - -Outer regional locations having 73.6 Pharmacists per 100,000 in the population;
  - -Remote locations having 61.8 Pharmacists per 100,000 in the population; and
  - -Very remote locations having 39.8 Pharmacists per 100,000 in the population.

Key issues noted that are expected to impact on the Pharmacy workforce over the coming years include the continued maldistribution of the workforce, the impact of complex funding arrangements on the workload for hospital Pharmacists, changing models of care and work settings (to a more multidisciplinary focus), expanded scope of practice (for example pharmacists as immunisers) and increasing demands for the pharmacy workforce based on an ageing population and increased levels of chronic disease. It should be noted that the ageing of the Pharmacy workforce was noted as being significantly better than other clinical health professions under review. EMM and technological reforms were not identified as a key workforce issue.

4.2 Workforce models

In Australia the Society of Hospital Pharmacists in Australia has released suggested hospital clinical pharmacy staffing levels based on service type, It is anecdotally understood these are a guide only, and that NSW Health does not use these to determine staffing levels. A summary of this is provided below. [19]

Category	Beds to Pharmacy FTE	Category	Beds to Pharmacy FTE
Critical Care Units	10	Minimal change to medicines anticipated	30
Specialist Units, high dependence on medicines	15	Day surgery	110 patients per week
Medical Bed type	20	Longer stay admissions	30
Surgical bed type	25		

Other than this Australian guide, there is limited literature available on pharmacy workforce models outside of the US context, where major health care reform (i.e. Patient Protection and Affordable Care Act) has advanced the drive for an improved workforce model. Across the US, there is a strong drive to develop a future-oriented pharmacy practice model that recognises pharmacists as providers of direct patient care, and to enable efficient and effective medication management practises whilst preventing errors.

4.2.1 The Pharmacy Practice Model Initiative

The Pharmacy Practice Model Initiative (PPMI) serves as a guide for these practice models, focusing on expanding clinical pharmacist roles, expanding pharmacy technician operational roles, developing appropriate training and credentialing for pharmacy staff, optimising automation and technology, and taking ownership of the medication use process.[23] The American Society of Health-System Pharmacists (ASHP) and the ASHP Research and Education Foundation sponsored PPMI with the objective of determining patient-care-related services for which pharmacists have responsibility whilst working alongside physicians, nurses, and other clinicians. The model emphasises the importance of identifying emerging technologies to assist with successful integration of a new framework.

4.2.2. Pharmacy Practice Models (University Health System Consortium)

In 2007, the University HealthSystem Consortium (Illinois, US) formed a taskforce to determine the pharmacy services that should be available to all patients in academic medical centres and to examine the evolving role of pharmacists in providing those services. The taskforce examined the four main pharmacy practice models that are used in the US to determine the "best way to deploy pharmacists, technicians, and technology in support of the ongoing transition from a product focus to a patient-centred care model ensuring the safe and effective use of medications in all practice settings."[24]

The taskforce concluded that institutions need a practice model to support basic medication management services on a consistent basis for all patients and specialised services for specific patients depending on their clinical situations; and while technology may help achieve this goal, a well-trained workforce and an appropriate model design are critical for success.[24] The taskforce reported that not one, rather several dominant practice models are likely to evolve as organisations rise to meet the challenge of patient-centred care model ensuring safe and effective use of medications.

An overview of the different models is provided in Figure 1, with a full description of the workforce models and the EMM technologies used in each hospital setting provided at Appendix B.

Figure 1: Pharmacy Practice Models (University Health System Consortium)

Drug-Distribution Model

Philosophy: Pharmacists are the health care professionals best prepared and positioned to oversee the entirety of the medication-use system to ensure that it is safe and effective and provides optimal patient outcomes.

Johns Hopkins Hospital

- 950 bed hospital, average inpatient census 752 patients
- 100 budgeted FTEs for pharmacists
- 115 budgeted FTEs for technicians
- 27 clinical specialist pharmacists

Clinical pharmacist-centred model

Philosophy: To optimise the clinical expertise of pharmacists and other personnel in the medication-use process, including evaluating and implementing the use of enabling technology and extending the use of pharmacy technicians.

University of Michigan Health System

- Average daily census 775
- 50 pharmacist generalists
- 37 pharmacist specialists
- 103 technicians

Patient-Centred Integrated Model

Philosophy: Relies upon well-trained technicians and automation to run the drug distribution process, allowing pharmacists to focus on patient care and be deeply involved in the hospital's quality and safety agenda.

University of Minnesota Medical Center

- 4 inpatient hospitals, average daily census 300 (incl. 70 paediatric patients)
- 56 pharmacists
- 59 technicians/others

Comprehensive Model

Philosophy: Tailored to the context of the organisation, delivering optimum pharmaceutical care via integration of clinical and distribution services

SUNY Upstate University Hospital

- 378 beds (average 80% occupancy)
- 25 pharmacists
- 33 technicians

Notably, there are distinct variations between these practice models with respect to pharmacy staff-to-patient ratio. Appropriately, the patient-centred practice model has the highest ratio (.38, approximately 1:3) whereas the comprehensive model has the lowest (.15, approximately 1:6), whilst the other two models are roughly 1:4. There are also variations in the pharmacy-to-technician ratio. Each of the models are between 1:1 to 2:1 (technicians to pharmacists).

4.2.3 Clinical Services Capability Framework- Medication Management

Queensland's Department of Health Clinical Services Capability Framework (CSCF) provides information on service requirements for medication management services, organised in terms of increasing risk and complexity for medication services.[26] However the CSCF does not outline what this equates to in terms of workforce numbers for pharmacists, pharmacy technicians and pharmacy assistants.

4.2.4 Skillmix

There has also been research focused on the impact of technology on pharmacy practice, which outlines how some of the components of EMM systems, as well as pharmacy technicians, have the potential to free up pharmacists time to undertake other activities including providing direct patient care. [25]

This research suggests that this would likely reduce the number of pharmacists required in the workforce, although in Australia, the ratio of pharmacists to pharmacy technicians must not exceed the level currently acceptable to the registering authority of the state in which the pharmacy is situated, and where no registering authority guidelines exist, a ratio of two technicians to one pharmacist should not be exceeded.[37]

4.3 Workflow considerations

EMM provides pharmacists the opportunity to undertake a number of activities electronically, ultimately saving time which can be spent providing direct care to patients. However there are a number of key considerations to ensure patient safety and process improvement.

Figure 2 highlights at a high level the key touch points of pharmacy staff in the medication management cycle, recognising that this will vary by location. In the NSW model, EMM components will be introduced across the medication management continuum, ultimately achieving a closed loop EMM system.

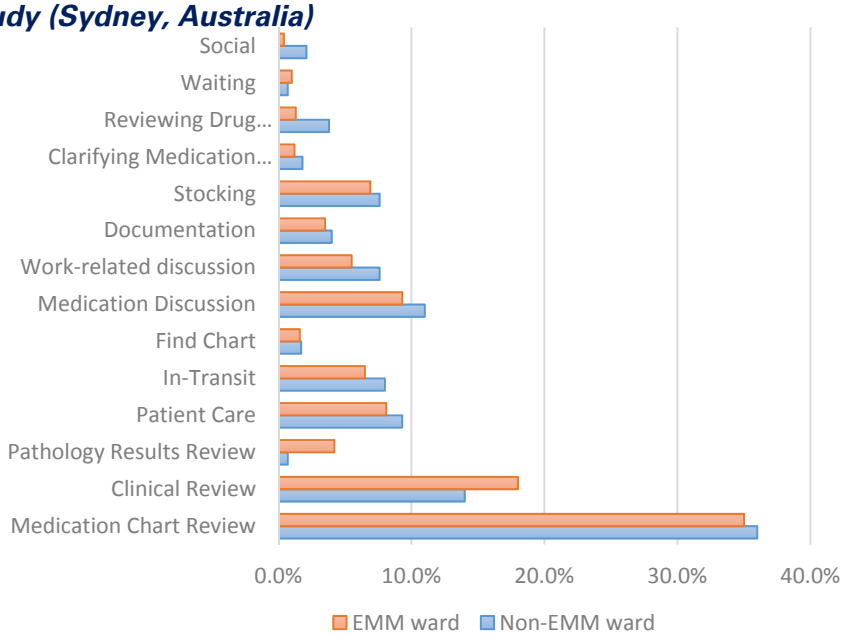
Figure 2: Medication Management Cycle

Source: Adapted by KPMG based on Stowasser, DA; Allinson, YM and O'Leary, KM (2004)

4.3.1 Time and Motion study (Sydney)

EMM has the potential to improve processes across the medication management continuum, potentially optimising efficiency, effectiveness and timeliness of each activity along the continuum. To test this, an observational time and motion study was conducted at a major Sydney hospital, during which eight pharmacists were observed - 3 on EMM wards, and 5 operating without EMM. The time it took to complete a series of tasks were markedly different, with EMM wards demonstrating faster and more frequent review activities, lower proportions of in-transit tasks occurring and a greater proportion of work occurring independently.[29] Figure 3 highlights the differing proportion of time spent on disparate activities in the EMM and non-EMM wards in this study.

Figure 3: Proportion of Hospital Pharmacists' time spent on tasks in observational time and motion study (Sydney, Australia)



Source: Adapted by KPMG from Lo C, Burke R and Westbrook J I (2010)

This study also demonstrated that pharmacists on wards with an EMM had lower rates of multi-tasking and interruptions than those on non-EMM wards. This finding is important because interruptions are associated with errors in pharmacy work and increased rates and severity of medication errors.[30,31] Interruptions and workflow disruptions can be attributed to a range of sources, including physical/spatial factors. One study found that an inefficient floor plan with high traffic areas produced high levels of interruptions.[32] Positive aspects as reported by professional staff who have been involved with an EMM implementation included aspects that made the processes more efficient, such as quicklists and streamlined processes that reduced the number of mouse clicks it takes to complete a transaction.

4.3.2 Impact of closed –loop electronic prescribing on staff time (London)

A study conducted in 2007 on the impact of pharmacy, nursing and medical staff time pre and post electronic prescribing found that this caused an increase in medical and pharmacy staff time, but that nursing time spent on drug rounds decreased. It should be noted that this study examined staff time over a 4 week period in a 28 bed general surgery ward of a London teaching hospital 6-12 months after electronic prescribing was introduced.[51]

4.3.3 Time and Motion Study of Physician Order Entry (United States)

In 2000 the Ohio State University Health System implemented physician order entry (POE) across four hospitals that include high acuity areas, such as surgical, medical, bone marrow and intensive care units.

The time and motion study component of this research found a significant decrease in medication turnaround time from 5 hours and 28 minutes pre-POE, to 1 hour and 51 minutes post POE. The phases with the most significant reduction where the communication of the order to the pharmacists (from 3 hours and 57 minutes to 33 minutes), and administration of the dispensed medication to the patient (from 3 hours and 16 minutes to 1 hour and 22 minutes). This study suggests that workflow accuracy and efficiency will be significantly enhanced with the introduction of EMM subject to factors including technical system design, education and training, clinician users, diversity of the patient population and method of POE deployment. [52]

4.3.4. Electronic prescribing impact on pharmacist work patterns (United States)

In 1998 a work sampling study was done at a hospital based outpatient pharmacy pre and post implementation of computer based prescribing. Overall this study found that total staff hours and number of prescriptions for pharmacists and pharmacy technicians were similar before and after computer based prescribing, However the type of work pharmacists performed, how they did the work and who they came into contact with differed under electronic prescribing – including that under electronic prescribing pharmacists spent:

- 12.9% more time checking prescriptions;
- 3.9% less time waiting for work;
- 2.2 less time in meetings;

- Approximately the same time entering information;
- 45.8% more time problem solving physician orders;
- 34% less time filling prescriptions;
- 3.3.% less time advising patients and/ or advising physicians about patient's treatments; and
- 4% more time working alone.

The finding that work tasks shift, but that overall workload for pharmacists under electronic prescribing remains the same (and does not reduce as is often hypothesised) is consistent with other literature. [53,54]

Another important finding of this study (while not the focus) was that technical support (from Pharamcy Technicians) remained constant in the type of work performed and the staffing levels- however the distribution of the type of work done, the reason for that work and the clinical contacts were likely to shift in response to pharmacy work tasks with EMM.[55]

4.3.5 Patient journey focus- whole continuum and all clinical roles

Mater Children's Hospital (Queensland) advises business process mapping for EMM implementation needs to include the entire patient journey from admission to discharge to assist with developing a transition strategy including transfers of paperless to paper-based discharge summaries and profiles, including any medication information.[6] This is consistent with the recommendation made by the Australian Commission on Safety and Quality in Health Care to use the medication management continuum and map to workflows. [12]

Linked to this, is the need to ensure the role of the pharmacist (along with pharmacy technicians and assistants) is not considered in isolation from other professional and clinical staff when examining and mapping the workflow impacts of EMM implementation. One study found a range of issues that impact workflow between pharmacy and nurses, such as stat medications taking a number of hours to get to the units, lost medication, pharmacy deliveries and restocking during the medication pass, waiting in line to retrieve medications, searching for the nurse with narcotic keys, pharmacy delivering patient medication to wrong storage device, pharmacy verification (time taken to verify).[33]

A separate study on nursing workflow in medication administration revealed that the activities occupying the majority of the nurses' time were obtaining medications (searching in designated storage areas on the units, automated dispensing cabinets, medication carts, or the refrigerators), verifying the medications and waiting for the medication to be sent by the pharmacist. The researchers suggested a bidirectional link to the pharmacy system so that communication between the nurse and pharmacists occurs in real time pharmacy system (such as electronic requests for medications restocking and for the pharmacy to prioritise the approval and delivery of medications based on the medication administration schedule set by the nurse.[34]

4.4 Change management and training for staff

With any large-scale change there will be challenges with implementation and resistance to change. The success of implementation ultimately rests with how the project is managed. However, well-planned change management processes, strong leadership and appropriate resourcing and training will give an EMM implementation project the best chance for success.

4.4.1 NSW Pilot Site findings

Early learnings from EMM implementation in the NSW context reveal that successful implementation is much more about the people than the technology. Following a one-year pilot program of an EMM system implementation, focus group and survey data highlight the positive and negative aspects of the program, with key themes centring around resistance to change and the need for training and support.[13] Indeed, the pilot experienced significant pockets of resistance to the program which were handled through carefully planned change management practices and demonstrating (over time) of the benefits that EMM had to offer. [13]

4.4.2 Queensland Health systematic review of workforce redesign

Queensland Health undertook a systematic review of 55 projects in the workforce redesign program across more than 13 health-care disciplines, including pharmacy. This study aimed to generate a deeper understanding and codification of the reproducible processes, or mechanisms, that lead to successful workforce reform in health care settings. The findings of this study, synthesized into three broad principles of workforce change include:

1. Drivers for change need to be closely linked to clinical practice and patient care. Workforce change needs to be driven by perceived or potential benefits to patients, staff and /or services at the local level.
2. The context for workforce change must be supportive at all levels. This includes a supportive legislative and industrial environment, professional environment, and leadership and champions.
3. Mechanisms for workforce change should include engagement of key stakeholders, access to resources to support the implementation and performance of the role, a facilitated change management process, and appropriate governance and support structures.[35]

4.4.3. Education and training

The need for education and training is a key recommendation across the literature. It is noted that this has been identified as not simply a 'one-off' initial training for the workforce. The Australian literature recommends that education and training should include initial awareness and education and training at implementation, targeted training for specific issues and or users, periodic refresher training and ongoing vendor support. [12]

4.4.4 Qualitative study of pharmacy workforce concerns

A qualitative study in the Australian context of a CPOE implementation project yielded valuable information on key concerns faced by clinical staff including pharmacists. Notably, pharmacists expressed concerns about:

- their changing roles, specifically that they would have a reduced physical presence in wards, or be confined to the dispensary rather than in the wards;
- the accompanying reduction in working with patients;
- the EMM system potentially being seen as a means of reducing pharmacy staffing levels;
- a reduction in personal communication and face to face interaction with other professionals, and fewer opportunities for informal discussions around medication issues (interviewees noted that face to face contact resulted in 'friendlier exchanges and less defensiveness on part of the clinicians);
- the functionality of the system, potentially exacerbated by pharmacy information systems not being able to integrate with the proposed new system, and having to work in different system environments;
- their training, while important, would draw from their own work or come at the expense of their own work;
- the possibility of a decline of doctor-patient contact and of new errors that might be introduced from remote ordering;
- an undermining of the importance of pharmacists seeing the patient to know what is best for them, and what medications are intended for them; and
- for 'order sets' (standard orders for certain conditions), which are not considered to be appropriate for everyone.

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- for 'order sets' (standard orders for certain conditions), which are not considered to be appropriate for everyone.

Section Five: Summary

Summary

Overall this literature review helps to highlight a number of gaps in research around the impact of EMM programs on the hospital pharmacy workforce, particularly in the Australian context. It also highlights a range of key learnings that can be applied to the NSW context.

The literature shows that there is currently strong support for EMM programs and their components in Australia, including from governments and key professional associations, as well as considerable interest and support internationally.

As well as a reduction in medication errors, a number of key benefits of an EMM are cited, including a reduction in variance in prescribing practice; improved legibility, completeness and availability of medicine orders; improved communication with patients about their medication; improved decision-making facilitated by information resources; more efficient and effective interactions among the clinical care team, cost effectiveness, improved clinical information sharing; minimised transcription errors; reduced duplication, reduction of waste and system wide inefficiency; prevention of the misalignment of records; and standardised, legible and complete orders.

However, the literature also suggests that EMM programs are complex and a range of risks and issues need to be effectively addressed and considered in order to achieve the expected benefits. These risks include insufficient funding, inadequate planning, insufficient change management and implementation supports. There are a number of examples where expected benefits have not been realised, with the Victorian Audit Report on HealthSMART flagging a range of key issues that are pertinent to the NSW context.

The impact of EMM on the pharmacy workforce is not well documented, with limited information of its impact on workforce models, skillmix and workflows. Despite this the literature strongly suggests that engagement around this is crucial to ensuring the EMM program is a success and that unintended consequences are easily and quickly addressed.

Workflows are identified as a particular area that is required in planning to help to identify unforseen issues with communication, process, sociotechnical risks. In addition the workflows if designed carefully, will assist in achieving the benefits championed by EMM supporters.

Any potential reduction in cost and workforce needed from such a change is a benefit that will only be realised in the longer term, with additional FTE expected in the short term while the workforce is adjusting to the new system. It is also noted that there are no 'best practice' workforce models or skill mix models for the pharmacy workforce in Australia, which may account for the differences in acuity, volume of services, workforce availability, adoption of the technician and assistant workforces.

Despite its limitations, there are a number of key insights from the literature that may be useful to the NSW EMM program of work, summarised on the following pages.

Key Insights From the Literature

General findings

i. The implementation of EMM programs is increasing both in Australia and internationally. It has significant support from governments, professional associations and the private sector.

EMM (and/ or its components) has already been, or is being, implemented in various forms and to varying degrees across the western world, including in the United States, the United Kingdom, Canada, Germany, France, Italy, Spain, Sweden, the United Arab Emirates, and New Zealand.

The implementation of EMM has strong endorsement both in Australia and internationally including support from the Australian Medical Association, the Pharmaceutical Society of Australia, the Pharmacy Guild of Australia and the National Health Hospitals Reform Commission.

ii. A number of potential benefits are driving the impetus for EMM. One of the primary drivers is an expected reduction in medication errors.

Other benefits identified from the literature include a reduction in variance in prescribing practice; improved legibility, completeness and availability of medicine orders; improved communication with patients about their medication; improved decision-making facilitated by information resources; more efficient and effective interactions among the clinical care team; cost effectiveness; improved clinical information sharing; minimised transcription errors; reduced duplication; reduction of waste and system wide inefficiency; prevention of the misalignment of records; and standardised, legible and complete orders.

iii. Many of these benefits are not realised initially, and are only expected once the EMM program is successfully embedded.

Some benefits of EMM are realised immediately (such as legibility of ordering, standardisation and completeness of orders, visibility of orders, no longer having to search for the medications paper chart and no longer waiting while a paper based chart is being reviewed by another clinician). However, many of the key benefits and drivers for the implementation of EMM are realised over time. Such medium and longer term benefits include improved prescribing practice, reduced errors and created efficiencies within the health system. EMM programs therefore require comprehensive implementation to succeed and fully realise the benefits they can provide.

iv. There are a number of cases where EMM has not succeeded or had limited success, including in the Victorian context. Key shortcomings include insufficient funding, inadequate planning, insufficient change management and implementation supports.

In October 2013, the Victorian Auditor General released an audit report outlining key risks and issues found following the planned roll-out of clinical ICT systems to nineteen public health services in Victoria. The Department of Health significantly exceeded the initial budget and ultimately only delivered the HealthSMART clinical ICT system to four health services[21].

This report highlights many of the risks and issues noted both internationally and in the Australian context that need to be considered for EMM. It is important to note that the findings from this project and other literature suggests the benefits of EMM are not guaranteed and these reforms require strong governance, funding, planning, change management and implementation in order to realise the benefits. This is a significant risk, given the cost of EMM programs.

v. There are a number of key learnings/ recommendations for the implementation of EMM identified in the literature. Strong governance is particularly critical.

These implementation learnings include:

- Clinical engagement for buy-in is critical - including strong management support and change champions.
- Substantial engagement with the workforce is needed throughout the project to address issues prior to, and during implementation. There should also be ongoing support provided once EMM is implemented.
- Strong governance and benefits realisation is needed to support the reforms - including support from executive leadership and sponsorship.
- Comprehensive staff training is critical for optimised efficiency and a safer patient care journey.
- A consumer focused approach results in higher clinical quality and efficiency, a safer patient environment, greater employee engagement and improved financial results.
- Workflow analysis is critical to understanding how EMM implementation will impact on the users and their roles, communication pathways and processes.
- The scope of the EMM program needs to be clearly defined, understood and communicated.

vi. Large scale EMM programs, such as the one in NSW, have benefited from 'lead' sites and a prolonged implementation period.

Implementation has consistently been more successful with lead implementation (or pilot sites) prior to roll-out to other sites rather than a 'big bang' rollout. The Gartner Report (2014) found that the 'big bang' approach has been associated with the greatest losses in productivity.[22]

EMM systems are complex in nature. Setting realistic timeframes has been found to be imperative to build confidence in the system and allow for the ongoing identification and resolution of problems. The literature shows a trade-off between the speed and efficiency of implementation and the level of acceptance by staff – the more progressive the implementation, the more likely staff are to accept and use the new technology.

vii. A number of change management practices have been found to be successful in assisting to embed EMM.

These recommendations include:

- Clinical champions and change agents to help 'sell' the benefits of EMM. These need to include both senior stakeholders and ward-level change champions;
- Initial and early engagement with stakeholders is beneficial - it provides the opportunity for the workforce and their concerns to be heard; and
- Stakeholder issues and concerns need to be addressed quickly, and where needed, escalated through the relevant governance structure.

viii. Education and training is critical to user adoption of the EMM system/s in use. It should not be considered a one-off, but instead an ongoing requirement to support and sustain EMM.

It is recommended in the literature that education and training should include initial awareness and education and training at implementation, targeted training for specific issues and or users, periodic refresher training and ongoing vendor support.

Key Insights - workforce, workflow or work task findings

As well as understanding EMM and its impacts on the pharmacy workforce, including through the planning, implementation and embedding phases, the horizons scanning included analysis of existing pharmacy workforce models, particularly those that apply in an Australian context that could be applied and relevant. In addition analysis of the research sought to identify any existing evidence on the work flow, workforce and work task impacts of EMM on the pharmacy workforce. The following summarises these key findings.

i. Australian Pharmacist workforce data from 2012 indicates that New South Wales has the lowest number of Pharmacists per population than any other state, with the exception of the Northern Territory. [18]

While the largest cohort of Pharmacists are based on New South Wales (31%), this is the lowest number of Pharmacists per 100,000 in the population than any other state or territory, with the exception of the Northern Territory. This workforce data includes both Pharmacists employed in retail and hospital environments. This suggests there may be lower levels of resourcing of clinical hospital Pharmacists in New South Wales than other states, which was explored in stakeholder consultations.

ii. The Pharmacist workforce remains concentrated in major cities in Australia, with higher proportions in metropolitan areas compared with regional, remote and very remote areas. [18]

Australian Pharmacy workforce data from 2012 found that major cities have 101.6 Pharmacists per 100,000 in the population compared with very remote locations who have 39.8 Pharmacists per 100,000 in the population. This analysis was not provided for each State so information on ratios for New South Wales were not available. It is also noted that these ratios include all Pharmacists, including those in retail and hospital clinical settings. This finding suggests that the workforce skill-mix, and scope of practice may be quite different when comparing metropolitan to regional and remote facilities which was explored as a contextual difference in consultations with stakeholders.

iii. There is no currently approved or endorsed pharmacy workforce modelling used by NSW Health to determine total FTE, skill-mix and levels of the pharmacy workforce (although guideline have been produced by the Society of Hospital Pharmacists in Australia). Instead, hospital pharmacy workforce staffing is a decision to be made at the local facility or Local Health District level, based on local contextual factors.

In Australia the Society of Hospital Pharmacists in Australia has released suggested hospital clinical pharmacy staffing levels based on service type, It is anecdotally understood these are a guide only, and are not used in NSW Health to determine staffing levels. There is limited further literature available on pharmacy workforce models outside of the United States, and it is understood that their pharmacy practices and context are very different to those in Australia. This finding suggests that assessment of the suitability of the resourcing and skill-mix of the pharmacy workforce at each facility in New South Wales would be difficult n the absence of evidence based benchmarks.

iv. While limited research currently exists on the impact of EMM on the clinical pharmacy workforce, there were some key findings on the work task impacts. This includes the following key findings:

- The time it took to complete a series of tasks in a paper based compared with an EMM ward were markedly different, with EMM wards demonstrating faster and more frequent review activities, lower proportions of in-transit tasks occurring and a greater proportion of work occurring independently.[35]
- Pharmacists on EMM wards had lower rates of multi-tasking and interruptions than those on non-EMM wards. [35]
- The introduction of an electronic prescribing tool increased medical and pharmacy staff time, but decreased nursing staff time in a 28 bed general surgery ward in a London teaching hospital 6-12 months after the introduction of electronic prescribing.[36]
- A time and motion study conducted in the United States found a significant decrease in medication turnaround time, particularly in the communication of the order to the Pharmacists (a reduction of approximately 3.5 hours) and in the administration of the dispensed medication to the patient (a reduction of just over 2 hours).[37]
- A work sampling study was undertaken at a hospital based outpatient pharmacy in the United States which examined the impacts based on analysis pre and post implementation of computer based prescribing. Overall this study found that total staff hours and number of prescriptions for Pharmacists and Pharmacy Technicians were similar before and after computer based prescribing. However under electronic prescribing Pharmacists spent 12.9% more time checking prescriptions; 3.9% less time waiting for work; 2.2 less time in meetings; 45.8% more time problem solving physician orders; 34% less time filling prescriptions; 3.3.% less time advising patients and/ or advising physicians about patient's treatments; and 4% more time working alone. [38]

v. A qualitative study undertaken in Australia in 2009 identified key concerns faced by health professional staff with the introduction of EMM systems. This included pharmacists concerns about:

- Changing roles and scope- specifically that they may have a reduced physical presence in wards, or be confined to the dispensary rather than in the wards;
- The EMM system potentially being seen as a means of reducing pharmacy staffing levels;
- A reduction in personal communication and face to face interaction with other professionals, and fewer opportunities for informal discussions around medication issues (interviewees noted that face to face contact resulted in 'friendlier exchanges' and less defensiveness on part of the clinicians);
- The functionality of the system, including pharmacy information systems not being able to integrate with the proposed new system, and the impact of different speciality settings;
- Education and training for the new system, while important, would come at the expense of their own clinical work; and
- An undermining of the importance of pharmacists seeing the patient to know what is best for them, and what medications are intended for them. [39]

Appendices

Appendix A: References

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Appendix B: PPMI workforce models (USA)

This table provides an overview of key information pertaining to the four key workforce practice models used in the United States.

Table 1: PPMI models commonly found in the United States

Model	Description of model	Example (including context and EMM technologies)
Drug-Distribution-Centred Model	Pharmacists are engaged primarily in drug distribution and reactive order processing but have little proactive involvement with the health care team in developing therapeutic plans for patients. Pharmacists have little accountability for outcomes associated with or leadership responsibility for the medication-use process.	Johns-Hopkins Hospital • $5.0 billion organisation with 950 beds • Over the past fiscal year, the hospital had approximately 47,000 inpatient discharges, 55,000 operating room cases, 86,000 emergency visits, and an average inpatient census of 752 patients • 100 budgeted FTEs for pharmacists and 115 budgeted FTEs for technicians; 27 clinical specialist pharmacists • The prescribing function of the medication use system is facilitated by the a computerized prescriber order entry (CPOE) system. The CPOE system is integrated with the pharmacy information management system via a customized 2-way electronic interface. Nursing documentation of medication administration is completed electronically. Medication distribution and storage are facilitated by automated dispensing cabinets (ADCs) for selected critical or emergency use drugs. The central pharmacy employs technology extensively. Robotic technology is used for unit-dose-cart fill, preparation of infusion syringes, and high-speed packaging. A carousel device facilitates picking and restocking of unit-dose medications by technicians. Intravenous admixture preparation is supported by a solution compounder. Technology is employed to facilitate the storage and distribution of controlled substances from the central pharmacy. Bar-code technology to support knowledge base drug administration is the focus of current evaluation.
Clinical pharmacist-centred model	Pharmacists are engaged exclusively in clinical activities with medical teams on the nursing units and accept little or no responsibility for issues related to the medication-use or delivery systems. There may be little or no collaboration between clinical and distributive pharmacists; these pharmacists have selective accountability for and ownership of the medication-use process.	• University of Michigan Health System (UMHS) (comprises 4 inpatient hospitals: University Hospital, C.S. Mott Children's Hospital, Women's Hospital, and the Cardiovascular Center) • Average daily census in inpatient facilities in 2009 is approximately 775; there are some 43,000 inpatient admissions annually and 1.6 million ambulatory care visits in UMHS facilities • Operates a central pharmacy and several satellite pharmacies • Inpatient pharmacy services are staffed by 50 pharmacist generalists, 37 pharmacist specialists, and 103 technicians • The hospital uses CPOE for all inpatient beds, as well as an electronic medication administration record. Pharmacy management software is used for inpatient pharmacy information. A robotic system provides 24-hour unit-dose-cart fill for adult inpatients, and an electronic system is used to repackage medications, with an internally developed program called for bar-code-labeled products. Vertical carousels are used for inventory management and bar-code-assisted distribution of drug products to pharmacy work areas, unit-based dispensing cabinets, and outpatient clinic locations. The ordering of drug products is fully integrated into the carousel system. The 18 Cardiovascular Center uses an ADC cartless dispensing model. For Children's Hospital and selected batched medications in the adult population, ValiMed™ is used to test high-risk parenteral medications to ensure the correct medication and concentration.

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Patient-Centred Integrated Model	Pharmacists accept responsibility for both the clinical and the distributive activities of the pharmacy department. Their clinical role is enhanced because well-trained pharmacy technicians manage most of the drug distribution. Pharmacists are proactively engaged in medication selection and use with the interdisciplinary team and exhibit a high degree of ownership of and accountability for the medication-use process.	• University of Minnesota Medical Centre, Fairview, University Campus • Fairview Health Services (FHS) provides a full continuum of health and medical services with 8 hospital-based care systems, 91 clinics, 6 urgent care centres, 30 retail pharmacies, and 39 orthopaedic and rehabilitation centres. The University Campus of the University of Minnesota Medical Centre, Fairview, is 1 of 8 Fairview Hospitals in Minnesota • Average daily census of approximately 300 high-acuity patients. Included in this number are 70 paediatric patients • Pharmacy staff is composed of 115 FTEs—56 pharmacists and 59 technicians/others. The vast majority of professional staff, especially those hired in the past 8 years, are doctors of pharmacy who have also completed a PGY1 residency. Decentralized pharmacy technicians are responsible for managing missing doses, and they also do rounds on the patient care units. Technicians have performed techcheck-tech since the 1980s for cart fill and more recently (since 2002) have expanded to checking ADC refills • Approximately 160 five-week Advanced Pharmacy Practice Experience student rotations are precepted annually; as well as pharmacy residents in training • CPOE has been implemented across FHS. There is currently an EMR system although conversion to another vendor is planned to take place in approximately 2 years. There is a cartless distribution model with ADCs. Wireless computers on wheels and CPOE allow pharmacists to be more efficient during patient care rounds.

Source: University Health System Consortium (2010)

Appendix C: EMM components

This table offers an overview of EMM components including benefits and limitations as outlined in the literature. This is not intended to be exhaustive.

Device/ technology	Description	Benefit to Pharmacy Workforce
Pharmacy robotics	Robotic random storage Automated dispensing machine (ADM)	Designed to eliminate selection errors, increase the speed of dispensing and increase storage capacity Benefits limited to full pack dispensing, given that individual patient dispensing is common; State/ Commonwealth divide prevents one-stop dispensing
Carousels for centralised inventory	Storage on horizontal or vertical shelves which revolve in a circular manner; only shelves containing requested medication are presented to operator	Designed for efficiency of imprest picking; have the potential to reduce selection errors due to limiting options Offer limited safety benefits; may be inefficient if staff have to walk to carousel to remove stock; still require staff to follow stock rotation principles to avoid expired stock
Automated Controlled Drug (CD) Management	Automated storage and electronic recording that is popular forward imprest storage and Pharmacy CD management	Removes the need for Pharmacy CD registers and potentially requisition books; have a high level of accuracy and seen to improve security of CD management and reducing/eliminating CD discrepancies; can offer dramatic time savings for Pharmacies and high levels of satisfaction amongst staff
Automated Unit Dose Drug Distribution Systems	Automated system for distributing single doses of medication (rare in Australia); may utilise carousels, robotics or conventional shelving, but have automated systems for packing and storing the unit doses	US studies indicate that they are safer for the patient; efficient and economical for the organisation; and an efficient method for utilising professional resources Overall found to be time-neutral in terms of time savings; to date Australia has favoured improved medication prescribing and recording through medication charts; systems require more pharmacy time
Barcode verification technology	Machine-readable representations of data relating to the medication to which it is attached	Has the potential to reduce medication administration errors In addition to using barcoding to identify products (in terms of the drug, strength, manufacturer and pack size) there is potential to facilitate recall issues Medication supply chains aren't yet harmonised rendering bar coding unworkable where coding systems aren't compatible
Drug reference and interactions databases	Automated database that allows pharmacists to individualise a pharmacotherapeutic plan efficiently to identify potential drug-drug interactions, disease-related concerns, dosing adjustments, and special alerts or black-box warnings	A pharmacist following a patient's inpatient progress can optimize the management plan on a daily basis, maximizing safety and efficacy when information is quickly and readily accessible during such times as interdisciplinary patient care rounds Drug-information databases and their integration into workflow may vary by healthcare provider and the clinical practice area
Audit Logs	A tool for data gathering to support professional practice, and manage operational issues within a healthcare provider organisation; maintains a log of all operations performed on the software, with a record of the operator, date and time of each operation	May assist with investigating critical incidents and identifying 'near miss' incidents; provides management information on the prescribing process which may assist with dispute settlement; provides information on system user behaviour, which may assist with guiding planners of user training and professional development Requires considerable front-end planning – determining database of users, roles and access permissions; challenges created by turnover of staff