

Report on

Safe Electronic Medication

Management

Systems Implementation Guide

Review

(Version: Final)

Contact Person Mr Stephen Parry-Jones Director of Pharmacy Mater Pharmacy Services Level 3 Mater Children's Hospital Raymond Terrace South Brisbane, Qld 4101 Tel: 07 3163 8220 Fax: 07 3163 1690 Email: Stephen.Parry-Jones@mater.org.au

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1.0 Executive Summary

On invitation from the Australian Commission on Safety and Quality in Health Care, Mater Health Services (Mater), by drawing on the experiences gained from the BadgerNet and other clinical systems implementation and post-implementation evaluation, has conducted the review of the Safe Electronic Medication Management Systems Implementation Guide from two perspectives:

- By determining the applicability of the Electronic Medication Management (EMM) Systems Guide within the context of medication management process in a private hospital setting; and
- By critically comparing the approach, structure, technical and functional requirements in the EMM Systems Guide with the local implementation process used for the BadgerNet application and other clinical database applications.

A Mater EMM Systems Guide review project team was formed. The team included neonatal pharmacists, system administrators from Information Services Department and nurse educators and facilitators from neonatology unit. Weekly meetings were conducted for six weeks to undertake the review tasks.

A series of tables have been prepared to guide the reader through a logical critique of the EMM Systems Guide in relation to the medication management process. Each table identifies the relevant section of the Guide and any relevant associated 'comments' from a Mater perspective.

The EMM Systems Guide is comprehensive. It encompasses all the key stages in project planning, management, monitoring and post implementation review. The Guide provides a sound foundation for the project planning and implementation.

The major barrier to successful clinical system implementation is the need to work with a proprietary system that was not purpose designed to meet functional specifications. User dissatisfaction and disengagement results from the lack of availability of a suitable proprietary system where there are protracted timeframes for software enhancements.

The attainment of safe, efficient and effective medication practices should drive the specification development of an EMM system, not the converse. The production and release of a validated EMM Systems Guide is the first step towards defining the core medication management functional components for an Australian EMM system; and will provide necessary supports in planning and implementation.

This has led to 10 key recommendations:

To meet Australian medication safety standards, vendors should comply with a minimum core set of EMM principles. An Australian EMM system should:

Encompass global medication safety concepts

- Adopt national and international health information management standards recommended for e-health interoperability
- Incorporate software functional specifications designed for safe medication management
- Have functionality to handle transitions of care
- Provide electronic and print access to a NMIC for real time recording and tracking of medication prescribing, dispensing and administration
- Provide electronic and print access to a Medication Action Plan
- Integrate with:
 - Proprietary pharmacy dispensing systems (used in both public and private health care);
 - Specialist clinical information systems
 - **Decision support applications**
 - Robotics and smart technologies
- Include guidelines to support all forms of prescribing (e.g. intravenous fluid orders, total parenteral nutrition solutions, anticoagulants and insulin) to promote a universal paperless electronic system, thus eliminating safety risks caused by combined use of paper-based and electronic systems
- Support printing of PBS scripts for inpatient and discharge medications unless a paperless claim process is approved by Medicare Australia
- Have the capacity to include commercial aspects (like health fund business rules, exceptional drug list, application for ex gratia payment for high cost drug).

The availability of proprietary EMM applications incorporating the core and desired functional components, as outlined in the EMM Systems Guide, and developed for Australian health environment will be a leap forward. The Commission should take a lead role in promoting the development of such EMM application that is suitable for use in the Australian health environment.

Eric Lee Assistant Director of Pharmacy

2.0 Introduction

In medicine, there is a principle of *"first do no harm"*. However, the inherent pharmacological activity of a medicine means that therapeutic benefits cannot be achieved without some risks, predictable, dose-related or idiosyncratic adverse events.

In practice, medicines are not always selected wisely or used safely, appropriately and effectively. This leads to wasted resources, preventable adverse events, and increased morbidity and mortality. Adverse medicine events (AMEs) encompass medication errors, interactions, misuse or adverse drug reactions. Internationally and in Australia, AMEs contribute significantly to health costs and human suffering.¹⁻⁶ However, there is a paucity of comprehensive and reliable data on their incidence due to their substantial underreporting⁷; and the fragmentation of health services - public versus private, hospital versus community.^{8,9}

In 1998, Roughead and colleagues¹⁰ published the first comprehensive review of drug-related hospital admissions from Australian studies. They estimated that approximately 2% to 4% of all hospital admissions, and up to 30% of hospital admission for patients greater than 75 years of age, were medication-related. Of significance was that approximately half of these were preventable. A decade later, this team revisited their research and found that medication errors remain the second most common type of medical incident reported in hospitals, and of all medication errors, omission or overdose of medicines occurs most frequently.¹¹ They recommended the development of strategies to reduce medication errors as a means of significantly improving patient safety in hospital. Electronic medication management (EMM) systems have been proposed as one such strategy.

EMM systems are designed to support the hospital medication continuum prescribing, supply and administration of medicines. They aim to reduce medication errors through improved prescription legibility, dose calculation, timely clinical decision support and improved linkages between clinical information systems. However, there is a risk to safety and quality of care if the EMM system is inadequately designed, poorly implemented or under-resourced.¹²⁻¹⁴

With many Australian hospitals planning or in the process of implementing EMM a system, pooling the collective experience of hospitals, both public and private, is a cost-effective strategy to minimise risk.

3.0 Mater Health Services

Mater Health Services (Mater) is a not-for-profit provider of health services. Mater's aim is to provide exceptional health cares to insured and uninsured patients, from neonate to elderly, via its seven hospitals (Mater Adult Hospital, Mater Children's Hospital, Mater Mothers' Hospital, Mater Adult Private Hospital, Mater Children's Private Hospital, Mater Private Hospital –

Redland) on two campuses (at South Brisbane and Redland) and via a medical research institute, pathology and pharmacy businesses.

Mater's information and communications technology (ICT) strategy adopts the best of breeds approach, providing cabled and wireless networks to support and integrate specialist applications; and to ensure services are delivered close to patient bedside where technology permits. Electronic medication management systems implementation is a key component in delivering these aspirations and in achieving the zero preventable harm objective of the Mater's safety program, *SafeQuest – for a safer Mater Community*.

Although the Mater Corporate electronic medication management system implementation is not imminent, the electronic health record platform on which electronic medication management system operates is progressively being rolled out across the Mater facilities; and a business case for the electronic medication management planning is being considered for submission to Mater executive this year. Over the years, a number of electronic medication management clinical information systems have been implemented at departmental level, in critical care and specialty service areas e.g.:

- PICIS for paediatric intensive care unit;
- CHARM for clinical oncology services; and most recently;
- BadgerNet for the neonatal units.

By drawing on the experiences gained from the BadgerNet and other clinical systems implementation and post-implementation evaluation, Mater Health Services has conducted the review of the Safe Electronic Medication Management Systems Implementation Guide from two perspectives:

- By determining the applicability of the EMM Systems Guide within the context of medication management process in a private hospital setting; and
- By critically comparing the approach, structure, technical and functional requirements in the EMM Systems Guide with the local implementation process used for the BadgerNet application and other clinical database applications.

4.0 Medication Management Process

Conceptually, the medication management process and medication safety awareness in a private hospital setting do not differ greatly from that in public hospitals. It is the governance, resources, medication supply and health fund approval process that challenge and warrant consideration in the medication management process and EMM system implementation.

4.1 Governance and Resources

In private hospitals, the operational management structure comprises of an Executive Director and Director of Nursing with decision supports from a Medical Advisory Committee and / or Drug and Therapeutics Committee, with representatives from medical specialties and pharmacists. Representatives from these committees would be the principal stakeholders and serve in the project board responsible for the timeframes, quality and financial aspect of an EMM system project. Through these committees, the various medical craft groups would be informed of the project and where applicable, support requested as project reference or specialty groups

In contrast to public hospitals, private hospitals may lack an equivalent medical hierarchical structure of Medical Director, registrar, senior and junior medical officers. Thus the medical resources that could provide direct user inputs and user acceptance testing for system implementation are not available. Medical specialists use the EMM system primarily for inpatient and discharge Pharmaceutical Benefits Scheme (PBS) prescribing. Day to day patient care and medication management are largely provided by nursing and pharmacy staff. Recording of admission drugs and discharge medication profiling are the shared responsibility of pharmacy and nursing staff. It will be a challenge to engage visiting medical specialists to commit and participate in testing and system evaluation during build and configuration stages. Education and training sessions for medical specialists need to be concise and available in flexible delivery formats, with interactive, online resources developed to supplement oral presentations at staff meetings. Online materials have the added advantage of 24-hour 7-day access for motivated staff and serve as a refresher for those using the system intermittently. A system with capability for remote access would encourage buy-in and participation from medical specialists.

A key functional role of an EMM system is the support of safe medication management practice through a carefully designed, balanced and configured database with access to accurate medicine references, built-in dose monitoring, and system alerts. The responsibility for the initial system customisation, ongoing database maintenance and policy development will place considerable strains on the limited resources of the Drug and Therapeutics Committee in the private hospitals.

4.2 Medication Supplies and Health Fund Approval Process

In public hospitals, a formulary, with listings approved by a designated Drug and Therapeutics Committee, governs the medicines available to prescribers. Through the formulary, prescribing can be restricted to senior doctors or to specialty areas. Generic prescribing facilitates the stocking of only one trade brand of the formulary-listed drugs. In private hospitals, all Therapeutic Goods Administration registered brands of medications can be prescribed. The Pharmaceutical Benefits Scheme (PBS) listing and the various versions of Exceptional Drug Lists adopted by selected health funds are de-facto formularies. The selection of the drug entity and brand is at the discretion and preference of the prescriber. Such open access (with restrictions imposed by external jurisdiction) is at odds with the medication safety concept embedded within the use of formulary and treatment protocols, as defined in the medication management system and ratified by local Drug and Therapeutics Committee. Legal ramifications aside, it is a huge task to customise the decision support and clinical alert databases for private hospital use. Balancing medication safety against risk of alert fatigue requires innovative programming, with an alert display that ensures high risk alerts are acknowledged and actioned.

Converting the admission medication history to an inpatient medication chart for recording dose administration is normally performed by nursing staff, based on doctor's referral letter or medication list supplied by patient's care facility. The EMM system needs to have the capability to retain (or access) an electronic image of the referral letter or supplied medication list. There should also be provision on the electronic medication chart for dual recording of the user identification code of the witness and transcribing staff, as well as the prescriber's.

Cost reimbursement of supplied Pharmaceutical Benefits Scheme medications from Medicare Australia mandates submission of paper prescriptions with each claim. The current use of carbonated inpatient charts is designed to facilitate the scripting process for hospitalised patients. A carbonated chart is not suitable for printing with laser printers. Use of pre-printed forms requires dedicated printers and restricts sharing of devices. The proposed use of a carbonless National Inpatient Medication Chart (NIMC) (as a medication order / administration record) would require the implementation of a paperless PBS claim system or an EMM system capable of generating PBS scripts locally or emailing script images to the medical specialist's practice. Integration between a medication management system and pharmacy dispensing system would enhance workflow, eliminate the need for script transcription and facilitate script printing. To enhance medication safety and to complete the scripting cycle, these functional specifications need to be included in the next version of EMM system guide.

Apart from medication safety and process improvement, a medication management system needs to support the health fund billing and high cost drug application process, a vital business component in private health sector. In various terms, most health fund agreements stipulate prior application from the prescriber for approval to use high cost drugs. Systems alerting the prescriber for submission of an application at the time of prescribing will eliminate delay in treatment and potential financial loss by the institution. Recording of the high cost drug application status in the EMM system will make the reason for delaying or withholding treatment transparent to all users.

5.0 EMM System Guide Review

The EMM System Guide is comprehensive. It encompasses all the key stages in project planning, management, monitoring and post implementation review. The Guide provides a sound foundation for the project planning and implementation in the absence of a local corporate information system project management framework. It is the execution of the guide, contents and project plan by the project manager, in consultation with the project management board / sponsor that determines the outcome of the project. This execution is a combined result of the implementation planning study, project scoping, resource availability, timeframe, user engagement, user consensus on process changes and standardisation, and most of the all, the

availability of suitable software and the level of customisations and enhancements required to develop a complete software package.

The general principles and procedures in the implementation guide from project scoping / initiation through implementation go-live activities to ongoing operations are generic to most electronic system implementation and change management processes. The features that differentiate an EMM system from other electronic systems are the principal stakeholder, key users, medication specific issues, and the functional and technical specifications.

A series or tables have been prepared to guide the reader through a logical critique of the EMM Systems Guide in relation to the medication management process. Each table identifies the relevant section of the Guide and any relevant associated 'comments' from a Mater perspective.

	EMM Systems Guide - Section	Comments
	Preface	-
	Acronyms and abbreviations	-
1	Introduction	-
1.1	The medication management process	 In relation to Figure 1.2, <i>Preadmission / Admission assessment and drug history</i> by telephone interview or by correspondence – EMM needs to: Import information from other external systems (e.g. PCEHR or prescribing system from doctor's room. Scan of referral letter or medication list. In relation to <i>Decision to Prescribe</i> – EMM needs to: Apply doctor's preference and formulary restrictions per user security levels Provide decision supports (including HCD prompt, SAS, and health fund) at prescribing as well as medication administration. Accommodate scripting by RNs in private hospitals (and associated tracking); this requires policy and authorisation. Make EMM easily accessible to all care providers. Integrate EMM with electronic imprest cupboards Allow printing of medication information (CMI and /or PI) for inpatient and discharge patients. Integrate the decision to supply with the dispensing system and printing of PBS scripts
1.2	The EMM system implementation process	Figure 1.3 provides a generic approach applicable beyond EMM.

Table 1. Review of the medication management process

The Guide describes the five stages of project implementation. Stage 1 (Project initiation) to Stage 4 (Implementation go-live) includes the following activities:

- Engagement and sponsorship from principal stakeholders and key users;
- Appropriate product selection, quality project management and communication strategies to ensure project completion within the allocated resources and timeframes;
- System configuration and build;

• Functional and technical specifications and ongoing operations to determine not only user acceptability of the system but also its success in delivering the project objective of medication safety.

The major barrier to successful clinical system implementation is the need to work with a proprietary system that was not purpose designed to meet functional specifications. User dissatisfaction and disengagement results from the lack of availability of a suitable proprietary system where there are protracted timeframes for software enhancements. This is exacerbated by poor project scoping where there is inadequate consultation and user involvement in process mapping and resource estimates. These factors ultimately lead to ongoing post-implementation grief.

The availability of a ready-to-use proprietary system with minimal customisation and integration would facilitate implementation and reduce transitional problems associated with system inter-operability and parallel use of paper and paperless processes. To achieve this ultimate goal, the EMM system guide should assume a more authoritative role in setting the required core data structure and defining required national standards so that vendors can develop comparable applications with standardised key medication management features. This will also have the economic benefit of attracting more competitive tenders, with implementation facilitated by cost-savings to end-users (Table 2).

1401	Table 2. Review of Abbut this toolkit		
	EMM Systems Guide - Section	Comments	
1.3	About this toolkit		
1.3.1	Purpose	In addition to medication safety, medication management also includes financial aspects in a private hospital setting – these aspects have not been enunciated in the Guide.	
1.3.2	Scope	 Elements currently excluded from the Guide i.e. fluids for infusion orders an interface with pharmacy dispensing system an interface with community prescribing and dispensing systems (including PBS online claims) are critical elements that contribute to patient safety and are integral to the financial viability of the private hospital system. 	
1.3.3	Contents	-	

Table 2. Review of "About this toolkit"

5.1 Principal Stakeholders and Key Users

Securing full supports from executive leadership team is critical for the success of the project and for project alignment with strategic directions from a corporate, information and communications technology perspective. In private hospitals, nominated medical specialists from a Medical Advisory Committee could act as the medical representative and convey project objectives and progress to the medical craft groups. However, it would be beyond their jurisdiction to fulfil the listed responsibilities for 'the director of medical services' in the EMM Systems Guide.

Recognition of EMM systems as a corporate priority by principal stakeholders ensures involvement by all departments and adequate resources and funding for building the required information technology infrastructure and timely completion of the project.

The functions and responsibilities of the principal stakeholders outlined in the EMM Systems Guide are appropriate for a public rather than private hospital setting. Supervision of project scoping and review of the business case should also be the responsibility of the principal stakeholders. The success and user acceptability of EMM system will depend on a sound and robust information and communications technology infrastructure, with reliable operating platform performance and information technology supports. The chief information officer should be attuned to the delivery timeframes of both information and communications technology architecture and EMM system. Unless it is a green field start, most hospitals would have already acquired various clinical systems. It is important that the chief information officer, taking into consideration of the business case the specifics of how and if the EMM system is to be integrated with these clinical systems prior to product selection and finalisation of functional specifications.

Given it is the medication management system that underpins medication safety, there are considerable stakes for pharmacy to ensure the success of the implementation, especially if the system is to be integrated with pharmacy dispensing and inventory control systems. Although not to be seen as a "pharmacy project", the director of pharmacy, under the auspices of a multidisciplinary Drug and Therapeutics Committee, should assume a principal role on the project board.

Subject to the Drug and Therapeutics Committee's terms of reference and the presence of other governance committees (such as a patient safety subcommittee and/or a policy review committee), the Drug and Therapeutics Committee should have the overall responsibility to oversee the reference information sources, clinical decision support systems and the formulary items used by the EMM system. The review of the EMM's functional specifications, system configuration, standard order sets, order lists and other medication safety features could be delegated to, or be conducted in collaboration with, other safety subcommittees. The practice of selective activation of individual alerts or groups of alerts within the EMM system has legal and ongoing system maintenance ramifications and should not proceed without due consideration.

Implementation of clinical systems by a clinical specialty unit is often perceived solely as a clinical application; with impacts on other care providers of the unit often overlooked in the early project planning phase by the project team. The involvement and contributions of these other care providers inevitably come too late to be incorporated in the final product, especially where resources are limited. Conversely, key users will under-estimate their contributions in the scoping and process mapping phases, if approached to participate with only limited knowledge or misconceptions of the project objectives. This can lead to an under-allocation of resource requirements for system configuration and build. Engagement of key users of the EMM system in the project scoping, process mapping, business case preparation, functional specification and product selection is essential for system configuration and build.

System suitability and workflow impacts will be identified and rectified in early phase of the project.

EMM systems impact on all care providers. Early engagement, thorough understanding of the rationale, realistic estimates of resource requirements and time commitment by the key users will facilitate project implementation and minimise conflicts of work and project priorities. Although not regular users of the EMM system, allied health professionals should also be briefed on the project at the scoping and initiation phase (Table 3).

	EMM Systems Guide - Section	Comments
2	Principal stakeholders and key	Most key stakeholders and users have been identified,
	users	with their key responsibilities declared. However, there
2.1	Principal stakeholders and	is no representation by a consumer or patient
	decision makers	advocate. They are a key stakeholder in this process as
2.1.1	Chief executive officer	recipients of the EMM service and end product.
2.1.2	Director of medical services	A consumer advocate can provide valuable input as to
2.1.3	Director of pharmacy	whether the intended deliverables of an EMM system
2.1.4	Director of nursing and	meets consumer needs and /or expectations e.g. they may
	midwifery	specify that BOTH the generic and ALL trade names are
2.1.5	Chief information officer	listed on a discharge summary, with the specific brand
2.1.6	Drug and therapeutics committee	dispensed highlighted. In contrast, health professional
2.2	Key users	input may only require listing of the actual brand
2.2.1	Prescribers	In addition, there would be value in appointing a
2.2.2	Pharmacists	Delationship Managar ' to angage with the
2.2.3	Nurses and midwives	stakeholders and manage their requests and any
2.2.4	Shared user responsibilities	associated frustrations associated with process changes
		associated individuous associated with process changes.
		 The Guide needs to be expanded to incorporate strategies to improve the engagement with medical staff, especially in the private health setting. Examples could include: Payment to offset loss of revenue during project participation (including employment hours in either a part-time or sessional arrangement and training hours) A quid pro quo for information access and exchange
		during the pilot phaseProvide formal recognition for their contribution to the project.

Table 3. Review of Principal stakeholders and key users

5.2 **Project Scoping and Initiation**

As EMM systems require extensive information technology infrastructure and supports, ensuring these are in place should be one of the project's strategic initiatives. Initial consultation between the chief information officer and director of pharmacy on the viability of the project should occur before project scoping.

Project scoping and business case preparation lay the foundation for the success, or otherwise, of the EMM system project. The scoping information must be comprehensive. The business case's timeframes, costing and recommendations must

be accurate, realistic and achievable. Scoping and business case should be prepared by a working party comprising of key users, senior information and communications technology technical staff, system trainers (and senior financial staff), under the guidance of the principal stakeholders. Formation of this working party should occur early, prior to project scoping. Inadequate consultations with key users are a major factor contributing to inappropriate system design, project slippage, poor implementation go-live and user frustration post implementation.

Among the factors listed in the EMM Systems Guide for initial project scoping, a detailed assessment of the existing cabled and wireless network performance, server response time and upcoming technology should be conducted individually or as part of the information technology infrastructure needs.

Wireless network and mobile technology are an integral part of the EMM system. The use of mobile devices and computers-on-wheels warrant a workplace health and safety impact assessment on staff and the facility. Suitable ward area design is required for appropriate storage and charging of mobile devices and computers-on-wheels. This review should be included in the project scoping study.

If a separate business case is to be submitted for information technology infrastructure, the EMM business case should make reference to the information and communications technology business case, its delivery timeframes and the EMM implementation approach. The viable EMM options of integrating with existing clinical systems and the associated risks of either project slippage need to be highlighted. Apart from hardware and software maintenance support costs, internal resources required for ongoing maintenance of the database, formulary, alerts and staff training should be factored in.

In the private hospital setting, the composition of the project team and frequency of meetings need consideration; as the medical officer involved is most likely to be a visiting medical specialist from the Medical Advisory Committee or the medical craft groups. Contributions and time commitment will be limited. The project manager, pharmacy and nursing representatives will take on greater roles for the project. Inputs from medical users or craft groups will be channelled through the executive director and the Medical Advisory Committee. In practice, the recruitment of a full time medical project team member and the formation of various reference and specialty groups are major hurdles. Providing funding to allow formal sessional participation of a medical officer in the project team can overcome this barrier (Table 4).

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	EMM Systems Guide - Section	Comments
3	Stage 1 — Project initiation	
3.1	Initial scoping study	These issues have been globally well described in the
3.2	Developing the EMM business case	Guide. Additional emphasis could be placed on
3.3	Obtaining funding approval	adequate project scoping and business case preparation
3.4	Governance	being critical elements to successful project
3.4.1	Project sponsor	implementation.
3.4.2	Project board	The project team will succeed or fail, based on their
3.4.3	Project manager	commitment to the project vision and their early
3.4.4	Project team	engagement and involvement in the project.
3.4.5	Reference group and specialty	
	subgroups	

Table 4. Review of Project initiation

	EMM Systems Guide - Section	Comments
3.5	Project management	While the structure and content of this section is
3.5.1	Role of the project management	appropriate, further guidance on selection criteria in
	office	recruiting an experienced, full-time project manager
3.5.2	Project management methodology	would be a useful addition to the Guide. This could be
3.5.3	EMM project schedule	presented as a check-list.
3.5.4	Risks and issues management	The ability of the project manager to lead the team is a
3.5.5	Project reporting	critical element for project success.
		The inclusion of a project management methodology is
		laudable; however should not be prescriptive as some
		organisations will already have a declared framework
		or methodology that needs to be adhered to.
3.6	Procurement, product evaluation and	The structure and content of this section provides a
	selection	useful guide; but most organisations have local ICT
3.6.1	Project procurement plan	policies that need to be adhered to.
3.6.2	Procurement considerations	
3.6.3	Tender documentation	
3.6.4	Tender evaluation	
3.6.5	Product evaluation and selection	
3.7	Contract management	The structure and content of this section provides a
3.7.1	Contract management plan	useful guide; but most organisations have local ICT
3.7.2	Contract management meetings	contract and tendering policies that need to be adhered
3.7.3	Monitoring vendor performance	to.

5.3 Implementation Planning

Business process mapping is a time-consuming task. It is often performed less than optimally due to either an insufficient time or resource allocation, or the project scope being over-simplified or too narrowly defined. Mapping of current process should not just be confined to medication management processes i.e. prescribing, medication review, dispensing and administration. The patient journey should also be mapped from admission (including source and admission entry point), inpatient care, transfers between wards and hospitals (in a multi-site campus), day and weekend pass, to discharge home or to other care facility. This information is useful to develop the transition strategy for the management of transfers between paper-based and paperless system, incorporation of printed medication information (such as patient medication list or profile) from external care facilities into the electronic system and printing of medication charts or summaries for transfer or discharge. Admission Transfer Discharges (ATD) messaging codes used in Patient Administration System (PAS) systems need to be identified and matched in the EMM system for appropriate action response and to avoid incorrect discharging and premature cessation of medications.

All print-outs or pre-printed forms currently used in association with patient care and medication management such as the care pathway, handover form, pre-admission drug recommendations, medication management plan, care plans (medical, nursing, pharmacy), discharge summary and discharge profile need to be collated and their use reviewed, to ensure the needs of each are met or improved in the EMM system.

In deciding the approach used to rolling out an EMM system, additional factors for consideration include the level of existing clinical specialty databases and electronic prescribing systems in use, and whether these systems are to be interfaced or replaced. In a multi-site campus, the information and communications technology readiness of

each site is another determinant. The experience of project team, patient throughput, case acuity, clinical workload and extent of admitted patient profiling, and data conversion are other additional factors to be considered.

In private hospitals, the prescribing staff are a diverse group of medical specialists and surgeons whose interest in and expectation for an EMM system are influenced by their sessional contact time and level of system use. Target change strategies that promote their use and system acceptability will be beneficial (Table 5).

	EMM Systems Guide - Section	Comments
4	Stage 2 — Implementation planning	
4.1	The implementation planning study	Of necessity, these elements are perhaps more
4.2	Business process mapping and redesign	familiar to those managing project or redesigning
4.2.1	Current-state process maps	processes in a private hospital setting. However,
4.2.2	Future-state process maps	what is valuable about the Guide is the micro-
4.3	Policy development	detail provided to guide specifically EMM system
4.4	Implementation sequence planning	implementation.
4.5	Change management planning	From a private hospital perspective, the Guide
4.5.1	Stakeholder assessment	hints at potential barriers or risks to successful
4.5.2	Targeted engagement strategies	implementation, with the inclusion of global
4.5.3	Change readiness assessments	approaches to overcome these risks. The value of
4.5.4	Addressing stakeholder concerns	appointing a Relationship Manager in this setting
4.5.5	Identifying champions and change agents	should be further emphasised.
4.6	Evaluation planning	The structure and content of this section provides
4.6.1	The evaluation framework	a useful generic guide.
4.6.2	Expected outcomes	
4.6.3	Baseline indicators	
4.6.4	Evaluation activities	
4.6.5	Checkpoint and milestone reviews	
4.6.6	Post-implementation review planning	
4.7	Benefits management planning	The structure and content of this section provides
		a useful generic guide
4.8	Education and training	Education and training is critical, especially to
4.8.1	Education planning and materials	achieve early adoption of new e-processes.
4.8.2	Training and materials	Regular opportunities for staff to reacquaint
4.8.3	Role-based tailored training courses	themselves with EMM processes in flexible
4.8.4	Dedicated training time and space	delivery formats should also be facilitated.
4.8.5	Timing of the training	
4.9	Project communications	The structure and content of this section provides
4.9.1	The communications plan	a useful generic guide. The Mater BadgerNet
4.9.2	Communication tools	project identified a communication matrix that
		clearly defined the communication channels for
		each stakeholder and user group which could be
4.10		adopted for an EMM system implementation.
4.10	Quality management	The structure and content of this section provides
		a succinct but useful generic guide

Table	5. R	eview	of in	pleme	ntation	planning
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5.4 EMM System Build and Configuration

To maintain continuity of patient care and to reduce user frustration, the central servers that host the EMM application must have adequate and expandable capacity to store increasing data while maintaining optimal system performance and network

response time. A scheduled routine of data backup ensures data recovery in the event of a system crash resulting in data corruption. There should be centralised monitoring systems overseeing the performance of the integration engines and wireless access points to make sure any disruption of data messaging or access point malfunctioning are rectified promptly. A secured remote access to the EMM system will offer alternate flexible access to the medical specialist, and facilitate medication review and prescribing.

EMM system configuration is time and resource intensive. In the absence of a local formulary in private hospitals and in view of legal ramification, it is questionable if there are sufficient benefits in customising clinical decision supports and selective activation of individual or group alerts.

Level of user access and prescribing rights for restricted items must be considered carefully and agreed upon by all key users. Configuration supporting medication security and medication safety principles must be balanced against the need for patient access to critical therapy.

Depending on the EMM system's functionality and hospital needs, there are always local customisations and functionality enhancements for future process that can only be achievable with an integrated electronic system. Pharmacy dispensing is an integral part of the medication management process. Integration between the EMM system and pharmacy dispensing system improves efficiency, productivity and minimises medication errors. Via Health Level 7 (HL-7) standard bidirectional messaging, patient demographics, allergy, formulary listing and restrictions, adverse drug reaction (ADR) alerts, cautionary prompts, prescription details and dispensing information can be passed between the two systems. Transcription of script details between systems is avoided and only a single formulary dataset to be maintained.

In addition, integration between the EMM system and smart electronic delivery devices enables prescribed dosing information to be sent directly to the devices, with dose and rate validated prior to infusion commencement. Dose administration data can be sent back to the EMM system for continuous dose and infusion rate monitoring.

With the advent in pharmacy automation, integration between the EMM system and electronic imprest stock cabinet would facilitate after hours pharmaceutical review and monitoring of imprest stock usage. The nursing staff would have the assurance of the medication reviewed by a pharmacist before obtaining a drug or dose from electronic storage.

The capability and functionality of an EMM system in feeding a discharge medication summary to the Personally Controlled Electronic Health Record (PCEHR), a National E-Health Transition Authority (NEFTA) initiative, should be considered for inclusion in the next version of the Guide (Table 6).

	EMM Systems Guide -	Comments
	Section	
5	Stage 3 — EMM	
	system build and	
	configuration	
5.1	Acquiring technical	When using shared infrastructure, it is important that the software
	infrastructure and	used is compatible; and also does not impact on the response time
	planning business	or performance of the application.
	continuity management	The network traffic on a shared platform also needs to be
		considered, especially when using a virtual environment.
		Where mobile technologies are to be employed, Occupational
		Health and Safety aspects need to be considered. These have not
5.2	Cofficient devialorment	been included in the Guide.
5.2	Software development	I his is the section of the Guide which needs to be
		There is currently a limited range of EMM system products
		available on the Australian market. Overseas products require
		customisation which is costly and has inherent risks
		The Guide does identify the core functions and the technical and
		medication safety standards that support a safe medication
		management safety system (p89-131). However, there is no
		mandate or incentives for EMM vendors to adopt these
		recommended specifications and standards.
		For example, there is National Product Catalogue (developed and
		endorsed by NEHTA) but it is at the vendor's discretion whether
		they choose to adopt the recommended standard.
		To launch the Guide, the Commission should run a workshop
		bringing together key stakeholders including identified potential
		software vendors, user groups, medication safety advocates and
		relevant jurisdictional representatives. This will provide an
		opportunity to focus on the need for EMM systems to meet
		recommended specifications; and for vendors to hear, first hand,
		of the clinical and safety consequences when their systems fail to
		do so. Political imperative may fast track success.
		A medication safety focussed example would be recommendation
		for use of TALL MAN lettering for labelling for 'Sound alike
		Look alike drugs'. Such a simple software enhancement could
		prove prohibitive in cost to the end user for currently available
		systems; unless it is built in as a core requirement of all EMM
		products.
		The Commission and its Guide has an opportunity to provide
		national leadership on this critical issue.
5.3	Building the technical	I ne structure and content of this section provides a useful generic
5.4	environments	guide. However, hospital information Communication Technology
5.4	Non-functional testing	(IC1) services will be responsible for these aspects.
5.5	Computation of EMM	I mis is very time-consuming process if <i>all aspects</i> are performed
	system content	Due consideration should be given to not only the ability but the
		appropriateness of individual institutions undertaking ongoing
		maintenance and/or local configuration of FMM system content
		National guidance on this issue, specifically in relation to
		medication risk and alert fatigue should be incorporated in this
		section.
5.6	Developing interfaces	The Guide provides the "ideal" in relation to interfacing key
	to key support systems	support systems. However, the reality is that degree of integration
	J 11 J	varies with different software.
		The Guide should also recommend interfacing with other Smart
		devices (e.g. infusion devices), prescribing software capable of

Table 6. Review of EMM system build and configuration

	EMM Systems Guide -	Comments
	Section	
		PBS prescribing.
5.7	User acceptance testing	The structure and content of this section provides a useful generic
5.7.1	Developing test scripts	guide
5.7.2	Informal user	
	acceptance testing	
5.7.3	Break testing	
5.7.4	Formal user acceptance	
	testing	
5.7.5	End-to-end testing	
5.7.6	Traceability matrix	
5.7.7	Acceptance and sign-	
	off	

5.5 Implementation and Go-Live Activities

The level of the EMM system's information technology live production environment's readiness at go-live determines the availability of on-the-floor support team staff and the subsequent user confidence and acceptability of the system. Patient profiling of admitted and new patients, patient throughput, case acuity and mix, user information technology skills and knowledge of the system all affect the experience and outcome of the go-live day. In the lead implementation approach, these are also the factors that determine implementation sequence. This becomes relevant when considering the inclusion or exclusion of the emergency department in the EMM process.

Under-tested software, untimely pre-go-live preparation, and inadequate clinical and support staffing on go-live day are the common frustrations reported in previous clinical system implementation experience. The project control centre is side-tracked to logging of system faults and communication with technical support. Instead of providing on-the-floor support to clinical staff, valuable support resources are consumed in system and infrastructure problem solving. It is rare that members of a reference group or specialty sub-group are present for the go-live. However, it is of doubtful benefit to have the reference group's presence on go-live day if the work is primarily data processing.

Completion of an implementation check list ensures EMM system readiness, software development and enhancement are completed, and integration and the application are operational in the test environment. In order to manage go-live workload impact, prego-live preparation such as updating of admitted patient profiles in the EMM system, printer installation and configuration, scanning or data entry of scheduled admission, and data conversion should be completed the night before the go-live day. Participation of key user representatives in the testing and pre-go-live tasks ensures early resolution of unexpected problems in the live environment. On go-live day, the EMM system is ready for the basic medication-related work of the admitted patients. Trained users can become familiar with a limited range of routine tasks while the support team and expert users can focus on new admissions and managing the patient transition tasks. Managing the patient transition between EMM and non-EMM clinical area and the parallel use of electronic medication management system and special paper medication charts is paramount to patient and medication safety during and post implementation. A separate transitional strategy is warranted to ensure medication order does not fall between the system gaps, no unintended cessation of therapy, duplicated dosing is avoided and paper-based medication orders are prompted for inclusion in the electronic discharge medication summary and profile. Where EMM system is integrated to pharmacy dispensing system, paper-based medications are dispensed and recorded in patient drug profile (Table 7).

	EMM Systems Guide - Section	Comments
6	Stage 4 — Implementation and go- live activities	
6.1	Implementation checklist	This is a very useful checklist that incorporates all required tasks are signed off and the system is ready for go-live
6.2	The project control centre	The structure and content of these sections provides a
6.3	Go-live roles and responsibilities	useful generic guide. However, to be successful there
6.4	Pre and post-go-live tasks	need to be sufficiently number of trained staff to be
6.5	Escalation strategy	on-hand on go-live day.
6.6	Managing the transition in a staged implementation	Managing the transition in a staged implementation is critical from a medication safety perspective. This point cannot be over-emphasised, with user acceptance testing of the application. Adequate policy and procedure should be in place to manage this transition.
6.7	Rollback	-
6.8	Project team exit strategy and transition to support	This needs to be well planned, with some continuity of staffing from Implementation to Maintenance stages.

Table 7. Review of Implementation and Go-Live Activities

5.6 **On-going Operations**

Critical success factors for ongoing operations include transfer of knowledge from the project team to support staff, continuity of expert users for system administration and database maintenance, continued and refresher education and training, reliable information technology and vendor supports.

It is routine practice to second clinical staff for full-time or part-time project participation during the implementation stage. Post implementation, most clinical staff return to their previous positions and, if given system administration responsibility, will carry the additional role on top of their clinical workload. Ongoing support from these expert users will be diluted. Should staff depart to pursue clinical aspirations; hospitals suffer a loss of system expertise. Unlike financial and administrative systems, it is testing to recruit a clinician to be a full or part time administrator for the clinical systems. In the case of an EMM system where regular updates and maintenance of formulary and protocols are critical for functional and safe operations, consideration should be given for a full time EMM pharmacist position, given pharmacists are medication experts and work in close liaison with the Drug and Therapeutics Committee. Ongoing monitoring and evaluation allow unexpected software faults and procedural inconsistencies to be identified and ratified as users' experiences increase. Procedures for logging system faults should be easy and simple, encouraging user feedback. Pro forma software notification forms could be used and emailed back to the system administrator for follow-up with the vendor or Drug and Therapeutics Committee. Quarterly audits and review of system reports by the Drug and Therapeutics Committee should be conducted to ensure correct system use and safe medication practices are consolidated.

A follow-up post implementation education and training session will be valuable to gauge user knowledge and feedback, especially after staff become familiar with the process and routine system functionality. Periodic refresher training sessions provide face-to-face interactions with current users and for training new staff. An interactive online training package would enable accessible staff learning at their own pace. Periodic emailing of hints, shortcuts and common errors by the system administrator would promote improved utilisation and understanding of the system. Sharing of user experience through informal user group meetings would identify unexploited areas of improvement (Table 8).

Iun	e of Review of ongoing operation	
	EMM Systems Guide - Section	Comments
7	Stage 5 — Ongoing operations	
7.1	Post-implementation review	The structure and content of this section provides a
7.2	Ongoing monitoring and	useful generic guide, highlighting the need for a prompt
	evaluation	response from the vendor through contract management.
7.2.1	Risk, issue and error reporting	Once staff become familiar with the application,
	protocols and tools	additional customisation is to be expected. This needs to
7.2.2	Ongoing evaluation of the EMM	be prospectively built into the maintenance contract.
	system	
7.3	Continuous adaptation	
7.4	Ongoing database maintenance	While this remains a local responsibility, user groups
		(e.g. Health departments) could share and reduce this
		load.
7.5	EMM software upgrades	This is a vendor responsibility. This needs to be
		prospectively built into the maintenance contract, with
		the timing of the upgrades appropriate to the service
		requirements.
7.6	Consolidating education and	There should be ongoing training and refresher packages
	training	in flexible delivery formats, with an abridged
7.6.1	Periodic refresher training	"hitchhiker's guide" version designed for short
7.6.2	Targeted training for specific	term/agency staff.
	issues and users	An internal user group should be established for data
		quality monitoring and to share useful tips and hints.
7.7	Ongoing vendor support	This is managed through the maintenance contract. A
		prompt response is required from the vendor in response
7.0		to critical issues.
/.8	Benefits realisation	-

Table 8. Review of ongoing operations

5.7 Functional and Technical specifications

The functional and technical specifications outlined in the Guide are comprehensive and provide an excellent framework for set up of vendor tender specifications. However, a number of functional components classified as desirable would be more appropriately classified as core functions within a medication safety framework and the continuum of care, in particular:

- Support for medication reconciliation;
- Patient identification through electronic technology;
- Guidance on valid forms, routes, frequencies, strengths and doses;
- Requirement for ordering or administration of some medicines;
- Prioritisation of medication orders for reviews;
- Access to current medication record during order review;
- Ability to suspend medication orders as required;
- Recording of substitution of medicine;
- Population of discharge medicines and discharge summaries from current medication record
- Reintroduction of medicines ceased or withheld on admission.
- Generation of take home discharge medicines list.

Configuration of EMM system contents and alerts is a very time-consuming process if *all aspects* are performed locally; and may prove risky from a medication safety perspective. Due consideration should be given to not only the ability but the appropriateness of individual institutions undertaking ongoing maintenance and/or local configuration. National guidance on this issue, specifically in relation to medication risk and alert fatigue should be incorporated in this Guide.

Table 9 provides more detail on selected functional and technical specifications. .

	EMM Systems Guide -	Comments
	Section	
8	Functional and technical specifications	
8.1	Prioritising EMM functional and technical components	_
8.1.1	Core features	Specified desirable features (above) need to be classified as
8.1.2	Desirable features	core functions within a medication safety framework and the continuum of care.
8.1.3	Aspirational features	-
8.2	Functional components	The EMM should be able to differentiate a transfer from a discharge message from the PAS to prevent inadvertent cessation of a medication order. The EMM system should support access configuration of prescribing of non-scheduled item such as enteral nutritional
		products by nonmedical staff where hospital policy permits.
		In the absence of formulary, the systems should be interfaced with the PBS for prescribing in the private hospital (and public hospital) setting.
		A paper copy of the prescription is currently required for a PBS claim. This is a major barrier to EMM system implementation in private hospitals.
		Apart from compliance with legislation and regulation, the EMM system must either be able to print a PBS prescription

Table 9. Review of functional and technical specifications

	EMM Systems Guide -	Comments
	Section	
		for inpatients in private hospitals OR Medicare Australia will need to move to a paperless claims process.
		Recording of a best possible medication history with capacity to track and assign ongoing changes to responsible health professionals; and creation of a medication management plan accessible to all care providers needs to be a centrepiece of the EMM system.
		The display of medication for selection, if only linked to route of administration, will omit non conventional delivery of drugs e.g. nebulised morphine. The system needs an override function to provide the capacity to search by drug.
		Where formulary restriction applies, the EMM system should differentiate specialist or VMO from junior medical staff to reduce the unnecessary alert.
		When a new medication is prescribed, the EMM system should check it against current medication profile (including regular, PRN, non-daily therapy) and alert prescriber of any duplication. Likewise, this applies to reactivated medication previously suspended or inadvertently cancelled.
		If auto-stop feature is applied, drug ceased by system should remain on patient profile until acknowledged to avoid inadvertent discontinuation of required medicine.
		Reportable codified data, not free text, should be used for recording of reasons for any order modifications or alert over- riding within the EMM system.
		Configuration of active alerts is very time-consuming process if <i>all aspects</i> are performed locally; and may prove risky from a medication safety perspective. Due consideration should be given to not only the ability but the appropriateness of individual institutions undertaking ongoing maintenance and/or local configuration of EMM system content. National guidance on this issue, specifically in relation to medication risk and alert fatigue should be incorporated in
		this section. Where EMM system is interfaced with CIS or pathology results system, the EMM system should BLOCK the medication administration when patient's clinical parameters or pathology results are outside the allowable range.
8.3	Technical components — software	Barcoding standards should be considered a core component from medication safety perspective. Where original pack is dispensed, this provides an added level of checking at the time of dispensing and administration.
		Where pre-admission clinics operate, theatre list should be available to the EMM system for pre-admission medication review prior to patient's admission for procedure.
8.4	Technical components — hardware	When using shared infrastructure, it is important that the software used is compatible; and also does not impact on the

	EMM Systems Guide -	Comments
	Section	
		response time or performance of the application.
		The network traffic on a shared platform also needs to be considered, especially when using a virtual environment.
		Where mobile technologies are to be employed, Occupational Health and Safety aspects need to be considered. These have not been included in the Guide.
8.5	Technical components — business continuity management	
9	Future considerations Glossary	_
	Any other comments on the EMM Guide	-

6.0 Alternate Solutions and Recommendations

Like any project management guide, the EMM System Guide is designed to address the four questions: *Why, Who, What and How*?

Section 1.3.1 of the Guide addresses the Why by stating the purpose is to "support the safe and effective implementation of EMM systems in Australian hospitals, with the overarching principle that the potential for harm as a result of poorly implemented electronic medication management systems should be recognised and minimised through diligence in product selection, work practice change and end-to-end implementation."

Based on "harm minimisation", the Guide has provided a very comprehensive approach and a toolkit to address the "Who' and "How" implementation of such an EMM system should be conducted. The variables that will impact, positively or negatively on successful implementation include the commitment of hospital, the skills of the project team and the extent to which the Guideline has been applied to the project. With adequate resources provided, strict adherence to each stage and planning as recommended in the Guide, there is a very high certainty of timely delivery of the desired outcome. In reality, most of the projects work within some financial, technical or product constraints and a scaled-down negotiated outcome is targeted. A national EMM System Guide promulgated under the banner of Commission on Safety and Quality will assist to pave the way to negotiate the appropriate level of project resources and improve compliance with the Guide.

The greater challenge remains exactly "what" deliverables are available for implementation. There are limited products for selection in Australia, even less with those adopting the established technical, information management and medication safety standards. Software customisation and enhancements are costly and pose substantial risks to project implementation. Mater's experience with the implementation of the clinical information systems has demonstrated the considerable time and effort required for software customisation and the subsequent negative impacts on the project delivery. The resultant application quite often requires further enhancements post implementation.

The attainment of safe, efficient and effective medication practices should drive the specification development of an EMM system, not the converse. The production and release of a validated EMM System Guide is the first step towards defining the core medication management functional components for an Australian EMM system; and will provide necessary supports in planning and implementation.

To meet Australian medication safety standards, vendors should comply with a minimum core set of EMM principles. An Australian EMM system should:

- Encompass global medication safety concepts
- Adopt national and international health information management standards recommended for e-health interoperability
- Incorporate software functional specifications designed for safe medication management
- Have functionality to handle transitions of care
- Provide electronic and print access to a NMIC for real time recording and tracking of medication prescribing, dispensing and administration
- Provide electronic and print access to a Medication Action Plan
- Integrate with:
 - Proprietary pharmacy dispensing systems (used in both public and private health care);
 - Specialist clinical information systems
 - Decision support applications
 - Robotics and smart technologies
- Include guidelines to support all forms of prescribing (e.g. intravenous fluid orders, total parenteral nutrition solutions, anticoagulants and insulin) to promote a universal paperless electronic system, thus eliminating safety risks caused by combined use of paper-based and electronic systems
- Support printing of PBS scripts for inpatient and discharge medications unless a paperless claim process is approved by Medicare Australia
- Have the capacity to include commercial aspects (like health fund business rules, exceptional drug list, application for ex gratia payment for high cost drug).

The availability of proprietary EMM applications incorporating the core and desired functional components, as outlined in the EMM System Guide, and developed for Australian health environment will be a leap forward. The Commission should take a lead role in promoting the development of such EMM application that is suitable for use in the Australian health environment.

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