electronic Medication Management (eMM)

Innovation and Systems Research

Presented by
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Senior Project Manager
Implementing an Electronic Medication Management (eMM) system within a hospital is a major transformational project that substantially affects clinical service delivery, hospital departments and the work of clinicians.

A Guide to Safe implementation of an eMM system reports that there are elements of hospitals’ medication management processes that have not been implemented as part of a comprehensive eMM system in Australia including:

- Infusions and monitoring of fluid balance
- Chemotherapy
- Renal dialysis
- Paediatrics
- Interfaces between the eMM system and hospital pharmacy stock control systems

The Children's Hospital at Westmead (CHW) is one of the facilities managed by The Sydney Children's Hospitals Network (SCHN).
High level Scope of the eMM project at CHW

- Paediatrics
- A fully integrated EMM solution
- Infusions and monitoring of fluid balance
- Oncology protocols / trials
- Chemotherapy
- Renal dialysis
- Interfaces between the eMM system and hospital pharmacy stock control systems
- Clinical Documentation including integration to Welch Allyn and Phillips vital signs
- Mobile devices
- Wi-Fi
- Single Sign On
Background

• One of three electronic Medication Management (eMM) pilot sites in NSW Health.
  • Concord and Prince of Wales

• This Project was the basis for research, conducted by the University of Western Sydney into the implementation and benefits of electronic medication management systems.
  • Phased in implementation with sequence of clinical areas randomised.
  • A period of heightened support for each area and conversion of medication charts being research requirements.
  • Observers on site in the hospital as each location / service was implemented.
  • Research expected to be published in 2017.
Background

- Characteristics of Medications in an acute Paediatric care setting:
  - Mostly ordered intravenously.
  - Almost all weight based.
  - Medication filtering by age in days.
  - Frequencies such as BD, TDS, Q4H but with patient specific administration times.
  - Medications are prepared in a medication room
  - Parents encouraged to take active role in child’s care and provide advice.
Background: Hospital Pharmacy Product List (HPPL)

A single list of pharmaceutical products used by hospital pharmacies across NSW.

Products descriptions are based on the Australian Medicines Terminology (AMT)

*Provides the foundation for linking Medication Orders and Pharmacy dispensed product via the AMT Identifiers*

*NSW Health specific iPharmacy interface business rules process these identifiers*
Why?

Medication errors

- leading causes of preventable adverse events.
- linked to drug-related morbidity, mortality, and prolonged length of stay.

eMM

✓ Improves legibility, accuracy, and accessibility of medication orders and enables monitoring of medication related activities.

✓ Strategy to reduce medication errors and inappropriate prescribing, improve decision support, workflow and productivity.

✓ A local study found that eMM systems were associated with a 55% reduction in total prescribing errors, and a 44% decrease in serious prescribing errors.
Key elements for a Safe and Successful eMM implementation

1. Medication safety awareness, tracking and governance
2. Top management team engagement, leadership and commitment
3. Sufficient funding to fully implement eMM within realistic timeframes
4. Robust governance structures
5. Senior medical staff who will use eMM and will champion its use to others
6. An experienced project manager and an appropriately resourced project team
7. Clearly defined clinical scope for eMM
8. Clearly defined relationships between the eMM system and other clinical and administrative systems.
9. Definition of the minimum level of clinical decision support that will be implemented
10. Bedside or Wi-Fi point-of-care access
11. Robust technical infrastructure supporting eMM 24/7
12. Integration with pharmacy dispensing systems
13. Business continuity plans that are tested and implemented.
Software

- **PowerChart** - Medication ordering
- **Pharmnet** - Pharmacy order review, product assignment and dispensing
- **iPharmacy** - Stock control

- **Citrix** - Application Delivery
- **Imprivata** - Enterprise Single Sign-On
- **Linux** - Server OS and **Windows 8.1** – Primary Client OS
Impact

Patient Journey

*Medication history / reconciliation*
Conversion (Admission / Discharge)
ED/CF/Middleton/Pre-admission
Clinical Pharmacy Review
*eMM to Paper to eMM*
Transfer (ED/PICU/OT/wards)
Transfer (CAPAC/oncology)
Procedural transfer
External transfers (Bear Cottage/another hospital/respite/home)
Discharge summary/Rx output
Intraop – Recovery - Ward
*Gatepass*
CAPAC

Clinical

Pharmacy dispensing (IP/OP/asap)
Cytotoxic/hazardous admin.
*Continuous IV order/admin.*
Standing orders
*Elimination of Phone orders*
*Clinical protocols - DKA*
*Order actions*
Tapering/patches
*TPN/Insulin/Warfarin*
CAPAC/Surgical/Electronic IP
Allergies and ADR/Ht and Wt
Weight based dosage calculator
*Medication Administration*

Specialised Clinical

Procedural clinics
*Haemodialysis/renal*
Orthopaedics
Metabolic meds
*Heparin*
*Chemo/oncology protocols*
*Home continuous IV*
Patient Friendly list
Patient Controlled Analgesia
Resus
Turner Intermittent/Future orders
*Downtime procedures*
Impact

• Medical Staff
  ✓ Medication Reconciliation, Prescribing, Discharge Summaries with context links to Pathology results and Medications orders
  ✓ Anaesthetists

• Nurses
  ✓ Medication Administration
  ✓ Nurse Practitioners prescribing
  ✓ Observations
  ✓ Fluid Balance
  ✓ Hospital in the Home

▪ Pharmacists
  ✓ Transitioning from imprest based system
  ✓ Product assignment
  ✓ Performing Pharmacy Clinical Consults that were recorded in the system
Conversion of the National Inpatient Medication Chart (NIMC)

- **Medical officers transcribe** the medications under the direct supervision of Project Team members.
- Transcription **double-checked by the ward pharmacist**.
- If a patient **was due to be discharged** during the conversion period or transferred to a non-eMM ward - stay on paper.
- If a patient was **admitted to the ward on the day of conversion** then the admitting medical team would order the patient’s medications in the eMM system.
- **STAT or once only medications** that were previously administered were not converted.
- **Ceased medications** were not be converted.
- **Paper medication charts remained on the ward with patient notes** and were scanned on discharge as per current process.
**Heparin IV Order**

### Details for heparin additive 2500 Units [30 units/kg/hr] + sodium chloride 0.9% infusion 50 mL

<table>
<thead>
<tr>
<th>Base Solution</th>
<th>Bag Volume</th>
<th>Rate</th>
<th>Infuse Over</th>
</tr>
</thead>
<tbody>
<tr>
<td>sodium chloride 0.9% infusion</td>
<td>50 mL</td>
<td>3 mL/hr</td>
<td>16.7 hr(s)</td>
</tr>
</tbody>
</table>

**Additive**

<table>
<thead>
<tr>
<th>Additive</th>
<th>Dose</th>
<th>Rate</th>
<th>Deliver</th>
<th>Occurrence</th>
</tr>
</thead>
<tbody>
<tr>
<td>heparin additive</td>
<td>2500 Units</td>
<td>30 units/kg/hr</td>
<td>150 units/hr</td>
<td>Every Bag</td>
</tr>
</tbody>
</table>

**Total Bag Volume**

- **50 mL**

**Weight:**

- **5 kg**
- **Clinical Weight:**

- **17/10/2016 09:44 AEDT**

**Infusion instructions**

Dilute 500 units/kg heparin in 50 mL sodium chloride 0.9% (total volume 50 mL).

1 mL/hr = 10 units/kg/hr.

Starting rate: < 1 year old: 25 units/kg/hr. > 1 year old: 20 units/kg/hr. CHW Procedure: Loading dose: 100 units/kg/dose. Maintenance: 20-40 units/kg/hr. Titrate dose according to coagulation results.
### Potassium Continuous IV Fluid

**Details for potassium chloride 20mmol/L in glucose 5% sodium chloride 0.45% infusion 1000 mL**

<table>
<thead>
<tr>
<th>Base Solution</th>
<th>Bag Volume</th>
<th>Rate</th>
<th>Infuse Over</th>
</tr>
</thead>
<tbody>
<tr>
<td>potassium chloride 20mmol/L in glucose 5% sodium chloride 0.45% infusion 1000 mL</td>
<td>1000 mL</td>
<td>40 mL/hr</td>
<td>25 hr(s)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Additive</th>
<th>Additive Dose</th>
<th>Normalized Rate</th>
<th>Delivers</th>
<th>Occurrence</th>
</tr>
</thead>
</table>

**Total Bag Volume:** 1000 mL

**Weight:** 5 kg

**Weight Type:** Clinical Weight

**Result dt/tm:** 17/10/2016 09:44 AEDT

**Infusion instructions:**
### Medication Administration Record

<table>
<thead>
<tr>
<th>Time View</th>
<th>Medications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Scheduled</strong></td>
<td></td>
</tr>
<tr>
<td>captopril</td>
<td>0.5 mg, Oral, TDS, post-cardiac surgery</td>
</tr>
<tr>
<td>Target Dose:</td>
<td>captopril 0.1 mg/kg (Actual Dose: 0.1 mg/kg) 17/10/2016 10:13:46</td>
</tr>
<tr>
<td>Not given within 5 days.</td>
<td></td>
</tr>
<tr>
<td>frusemide</td>
<td>5 mg, Oral, BD, diuretic</td>
</tr>
<tr>
<td>Target Dose:</td>
<td>frusemide 1 mg/kg (Actual Dose: 1 mg/kg) 17/10/2016 09:45:24</td>
</tr>
<tr>
<td>Not given within 5 days.</td>
<td></td>
</tr>
<tr>
<td>spironolactone</td>
<td>6.25 mg, Oral, BD, Potassium sparing diuretic</td>
</tr>
<tr>
<td>Target Dose:</td>
<td>spironolactone 1 mg/kg (Actual Dose: 1.25 mg/kg) 17/10/2016 09:45:47</td>
</tr>
<tr>
<td>Not given within 5 days.</td>
<td></td>
</tr>
<tr>
<td><strong>PRN</strong></td>
<td></td>
</tr>
<tr>
<td>paracetamol</td>
<td>80 mg, Oral, 6 hourly, PRN pain</td>
</tr>
<tr>
<td>Target Dose:</td>
<td>paracetamol 15 mg/kg (Actual Dose: 16 mg/kg) 17/10/2016 09:46:21</td>
</tr>
<tr>
<td>Not given within 5 days.</td>
<td></td>
</tr>
<tr>
<td><strong>Continuous Infusions</strong></td>
<td></td>
</tr>
<tr>
<td>heparin additive 2,500 Units [30 units/kg/hr]</td>
<td></td>
</tr>
<tr>
<td>sodium chloride 0.9% infusion 50 mL</td>
<td></td>
</tr>
<tr>
<td>3 mL/hr, IV Continuous Infusion, Anticoagulation, Order Review After: Bag # 1</td>
<td></td>
</tr>
<tr>
<td>Administration Information:</td>
<td>Pending Last bag started: 17/10/2016 10:56</td>
</tr>
<tr>
<td>heparin</td>
<td></td>
</tr>
<tr>
<td>NaCl 0.9%</td>
<td></td>
</tr>
</tbody>
</table>
The Computers on Wheels (CoWS)
Qualities of Innovation that make it acceptable / spread

1. Relative advantage
2. Compatibility with existing values and practices
3. Simplicity / ease of use
4. Trialability – (Pilot sites)
5. Observable results
eMM Statistics

**Reporting Period** (46 days)
- Monday 11-Apr-2016 to Thursday 26-May-2016

**Deployment Overview**
- Number of Beds now live = 131
- Number of Patients with medication orders = 654

**Wards Live**
- Mon 11-Apr to Sun 17-Apr - Hall / Clancy / RTC
- Mon 18-Apr to Sun 24-Apr – Bed-in period
- Mon 25-Apr to Sun 1-May – Bed-in period
- Mon 2-May to Sun 8-May - Commercial Traveller
- Mon 9-May to Sun 15-May - Ortho / Surgical
- Mon 16-May to Sun 22-May - Edgar Stephen
- Mon 23-May to Sun 29-May - Wade

<table>
<thead>
<tr>
<th>Metric</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>New patients with one or more medication orders placed</td>
<td>654</td>
</tr>
<tr>
<td>Medication Orders placed</td>
<td>7502</td>
</tr>
<tr>
<td>Occurrences of Medication Administration</td>
<td>35 443</td>
</tr>
<tr>
<td>Prescription Orders</td>
<td>280</td>
</tr>
<tr>
<td>Total Medication Alerts Fired</td>
<td>33 562</td>
</tr>
<tr>
<td>Total Medication Alerts Overridden</td>
<td>1 353</td>
</tr>
<tr>
<td>Height / weight / allergy (prescribing) forms documented</td>
<td>879</td>
</tr>
<tr>
<td>Nursing Admission Assessments documented</td>
<td>1 469</td>
</tr>
<tr>
<td>Nursing Initial Assessments documented</td>
<td>841</td>
</tr>
<tr>
<td>Discharge Summaries Signed</td>
<td>371</td>
</tr>
<tr>
<td>Duplicate medication tasks cleaned up</td>
<td>39</td>
</tr>
<tr>
<td>Potential Hot Key Errors Checked</td>
<td>37</td>
</tr>
<tr>
<td>Medication and PRN Response Tasks created</td>
<td>33 819</td>
</tr>
<tr>
<td>Total Discern Alerts Overridden</td>
<td>280</td>
</tr>
<tr>
<td>Allergies Documented</td>
<td>852</td>
</tr>
<tr>
<td>Results Signed via IView</td>
<td>5 333</td>
</tr>
<tr>
<td>IV Infusion Events Documented</td>
<td>20 095</td>
</tr>
<tr>
<td>Intermittent Med Events Documented</td>
<td>76</td>
</tr>
<tr>
<td>Meds Uncharted as In Error</td>
<td>339</td>
</tr>
<tr>
<td>eMAR Opened</td>
<td>114 182</td>
</tr>
<tr>
<td>Pharmacy Clinical Interventions Documented</td>
<td>10</td>
</tr>
</tbody>
</table>
The SCHN eMM Team at CHW