



Pyxis MedStations[®] The Future of Medication Management


Marilyn Crawley & David Ryan


Pharmacy Department – North Shore Hospital
Waitemata District Health Board




Background

- Automated unit used for the distribution and storage of medicine in clinical areas
- Interfaces with Patient Management System and Pharmacy Dispensing System
- Future interface with Electronic Prescribing System







Clinical Risk Management



- Promotes pharmacist intervention in detecting prescribing errors
- Minimises dispensing errors
- Minimises administration error due to the wrong choice of medicine and provides point of care warnings / alerts to nurses.

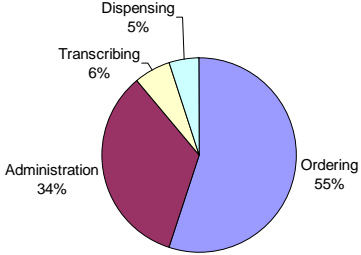


Medication Errors




- Errors can occur at any stage in the process of ordering or delivering a medication
- American research suggests that each patient experiences 1.4 medication errors per admission:


• Ordering	55%
• Administration	34%
• Transcribing	6%
• Dispensing	5%



Bates et al "Relationship between Medication Errors and Adverse Drug Events" JGIM, 1995




Medication Errors





- “Adverse drug events are common and often preventable. Many result from the prescribing stage, but many also occurred at the administration stage. Prevention strategies should target both stages of the delivery process”

Bates et al “Incidence of Adverse Drug Events and Potential Adverse Drug Events” JAMA, 1995, p.29-34




Medicine Distribution




Individual P

Pyxis Medstation in the Perioperative Area


Before Pyxis...



Waitemata
District Health Board
Te Wai Awhina




Ward trolley used for storing medications dispensed by pharmacy for individual patients.





Stockpiling of items not kept on imprest due to frustrations in obtaining medications through IPD.

Pyxis Medstation System




Waitemata
District Health Board
Te Wai Awhina



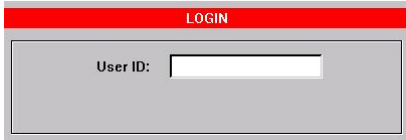



Medstation Security





Waitemata
District Health Board
Te Wai Awhina

- Access to the Pyxis Medstation is via a unique login for each user and a scan of their fingerprint.
- Access maintained by Pharmacy Department.











Pyxis Functionality




Waitemata
District Health Board
Te Wai Awhina


- User presented with Main Menu showing the different functions that are available.


Main functions for nurses – removing, returning & wasting medications





Pyxis Medstation System







- Prescriptions are reviewed by a clinical pharmacist before being entered into the Pyxis MedStation System.

- Nurses are presented with a list of the patient's medications that have been validated by a clinical pharmacist.

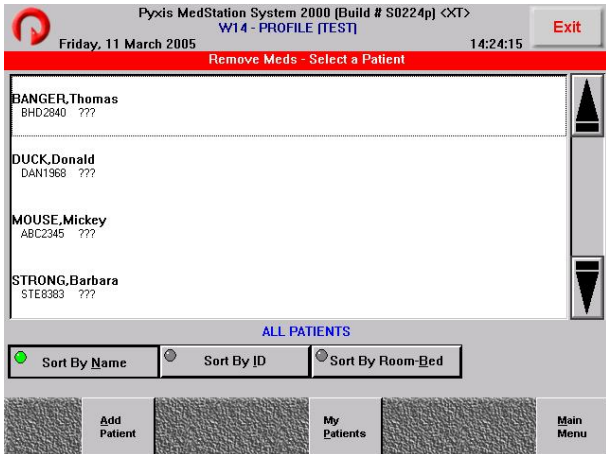


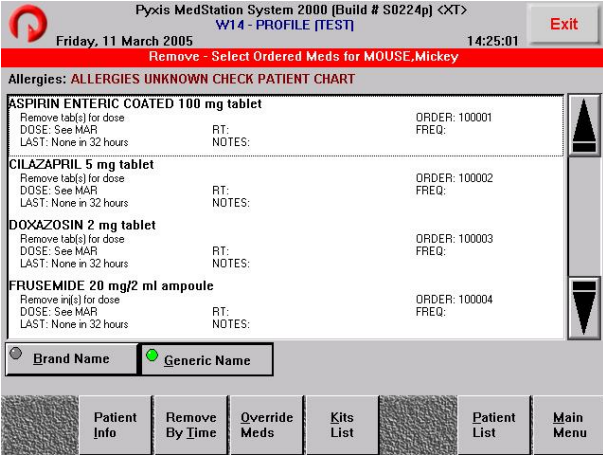


Removing Medication



- Nurse selects patient from a list populated by the Patient Management System (PIMS).





Removing Medication

Waitemata District Health Board
Te Wai Awhina

- List of medication displayed for patient that has been checked by a clinical pharmacist.

Pyxis MedStation System 2000 (Build # S0224p) <XT>
W14 - PROFILE (TEST) Exit
Friday, 11 March 2005 14:25:01
Remove - Select Ordered Meds for MOUSE, Mickey

Allergies: ALLERGIES UNKNOWN CHECK PATIENT CHART

ASPIRIN ENTERIC COATED 100 mg tablet Remove tab(s) for dose DOSE: See MAR LAST: None in 32 hours	RT: NOTES:	ORDER: 100001 FREQ:
CILAZAPRIL 5 mg tablet Remove tab(s) for dose DOSE: See MAR LAST: None in 32 hours	RT: NOTES:	ORDER: 100002 FREQ:
DOXAZOSIN 2 mg tablet Remove tab(s) for dose DOSE: See MAR LAST: None in 32 hours	RT: NOTES:	ORDER: 100003 FREQ:
FRUSEMIDE 20 mg/2 ml ampoule Remove in(s) for dose DOSE: See MAR LAST: None in 32 hours	RT: NOTES:	ORDER: 100004 FREQ:

Brand Name Generic Name

Patient Info Remove By Time Override Meds Kits List Patient List Main Menu



Removing Medication

Waitemata District Health Board
Te Wai Awhina

- Nurse keys in number of tablets / injections and touches on the **Remove Now** button.


Pyxis MedStation System 2000 (Build # S0224p) <XT>
W14 - PROFILE (TEST) Exit
Friday, 11 March 2005 14:25:45
Remove - Select Ordered Meds for MOUSE, Mickey

CILAZAPRIL
Remove tab(s) for dose
5 mg tablet

Ordered Dose: 7 8 9
See MAR

Remove Quantity: 4 5 6
[] tablet
1 2 3
0 . Del

Remove Now Select Next Med Review Order Cancel



Removing Medication

CILAZAPRIL
Remove tab(s) for dose
5 mg tablet
LAST: None in 32 hours


Please Remove:

1

 tablet

Drawer 10, Pocket 13
Dose: See MAR

Close Drawer When Done



Waitemata
District Health Board
Te Wai Awhina

- The drawer opens and the nurse is asked to remove the required amount of medication.





Removing Medication

CILAZAPRIL
Remove tab(s) for dose
5 mg tablet
LAST: None in 32 hours

Please Remove:

1

 tablet

Drawer 10, Pocket 13
Dose: See MAR

Close Drawer When Done



Waitemata
District Health Board
Te Wai Awhina

- Nurses are guided to the correct location of the prescribed medicine





Matrix Drawer

Waitemata District Health Board
Te Wai Awhina

- Good for storing large, bulky items.



Carousel Drawer

Waitemata District Health Board
Te Wai Awhina

- Pie-shape; access to single agent only





“Cubie” Drawer

Waitemata District Health Board
Te Wai Awhina

- Newest drawer type; ideal for small items.



“Cubie” Drawer

Waitemata District Health Board
Te Wai Awhina

- Every medication sealed by plastic cover...







“Cubie” Drawer

 **Waitemata**
District Health Board
Te Wai Awhina


- Lid opens, allowing access to single item...




Implementation


 **Waitemata**
District Health Board
Te Wai Awhina

- Initial pilot in one medical & one surgical ward in November 2001
- Progressively rolled out to all Medical, Surgical, HOAS & Acute Mental Health Units as well as the peri-operative area and emergency department.
- Implementations planned for August include maternity & the Mason Forensic Unit.








Patient Benefits




- Safer medication management system
- Range of medicines available in ward increased - over 98% of medicines available in the MedStation
- “Time to first dose” of medication significantly improved



Staff Benefits - Nurses



- Security - all medicines locked and secure
- Single point of access – less time searching for medications on the ward
- Access to any agent identified to an individual staff member
- 80% decrease in accesses to the After Hours Medicine Cupboard
- Controlled Drugs recorded electronically - registers no longer required





Staff Benefits - Pharmacy



Waitemata
District Health Board
Te Wai Awhina

- Secure and safe storage of medicines
- Inventory top-up requirements transmitted electronically to Pharmacy

WAITEMATA DISTRICT HEALTH BOARD - NORTH SHORE HOSPITAL - WARD 8

Station Location	Med Name Brand Name	MedID AltID	Max	Min	Current	Refill Issue	Actual Units
WB							
1.4	AMOXICILLIN/CLAVULANIC ACID 500 mg/125mg tablet	PHP146	100	60	57	43	_____
	Remove tab(s) for dose	TAB					N/A
1.14	METOCLOPRAMIDE 10 mg tablet	TAB107	100	20	17	83	_____
	Remove tab(s) for dose	TAB					N/A
1.15	OMEPRAZOLE 20 mg capsule	PHC092	90	30	30	60	_____
	Remove cap(s) for dose	CAP					N/A
2.5-1	TRAMADOL 50 mg capsule	PHS867	40	20	0	40	_____
	Remove cap(s) for dose	CAP					N/A
2.5-2	TRAMADOL 50 mg capsule	PHS867	40	20	0	40	_____
	Remove cap(s) for dose	CAP					N/A



Staff Benefits - Pharmacy




Waitemata
District Health Board
Te Wai Awhina


- Efficiencies in dispensing and distribution processes

WAITEMATA DISTRICT HEALTH BOARD - NORTH SHORE HOSPITAL - WARD 8

Station Location	Med Name Brand Name	MedID AltID	Max	Min	Current	Refill Issue	Actual Units
WB							
1.4	AMOXICILLIN/CLAVULANIC ACID 500 mg/125mg tablet	PHP146	100	60	57	43	_____
	Remove tab(s) for dose	TAB					N/A
1.14	METOCLOPRAMIDE 10 mg tablet	TAB107	100	20	17	83	_____
	Remove tab(s) for dose	TAB					N/A
1.15	OMEPRAZOLE 20 mg capsule	PHC092	90	30	30	60	_____
	Remove cap(s) for dose	CAP					N/A
2.5-1	TRAMADOL 50 mg capsule	PHS867	40	20	0	40	_____
	Remove cap(s) for dose	CAP					N/A
2.5-2	TRAMADOL 50 mg capsule	PHS867	40	20	0	40	_____
	Remove cap(s) for dose	CAP					N/A



Refilling Reporting



- Report generated in pharmacy showing the items that require refilling in each machine.
- Know stock levels of all medications on the ward at any point in time

Pyxis Refill & Delivery Report:
This report shows the items below Minimum in the Pyxis Machine you have selected:

North Shore Hospital - ECC-OBS

Drawer	Pkt	MedID	Medication Name:	Max	Min	Cur	Pick	Refill
3.0	35	PHG542	SALBUTAMOL INH 100mcg (200 dose)	6	3	3	3	___
4.0	59	PHA683	METOPROLOL TAB 47.5mg CR	30	15	10	20	___
5.0	64	TAB206	SOD VALPROATE TAB 500mg EC	20	10	6	14	___
6.0	11	PHG337	RISPERIDONE TAB 0.5mg	10	5	5	5	___
7.0	6	PHB896	MIXTARD 50/50 VIAL 100iu/ml (10ml)	2	1	1	1	___
7.0	7	CSP054	MONOTARD VIAL 100iu/ml (10ml)	1	1	1	0	___
7.0	9	PHH274	MYLANTA SUSP 500ml	500	200	0	500	___




Barcoding



- Trial commencing with all repacked loose tablets and medications in original packs being scanned into the machines instead of selecting them on screen.

Pyxis MedStation System 2000 (Build # S0224p)
CUBIE-TEST(RYAD) Exit

Wed Jun 15 13:16:55

Scan Barcode Item

Please scan the barcode label



Cancel

50 DIGOXIN TAB 250mcg
(LANOXIN)


Take with food

R4134 Ex. 01-Nov-06  Repacked: 15-Jun-05






Barcoding




- Even if incorrect medicine passes all other checks, will still open correct drawer in Pyxis machine.
- A barcode is included printed on all repacked medications, however the majority of items supplied to hospital pharmacy in New Zealand are not barcoded.

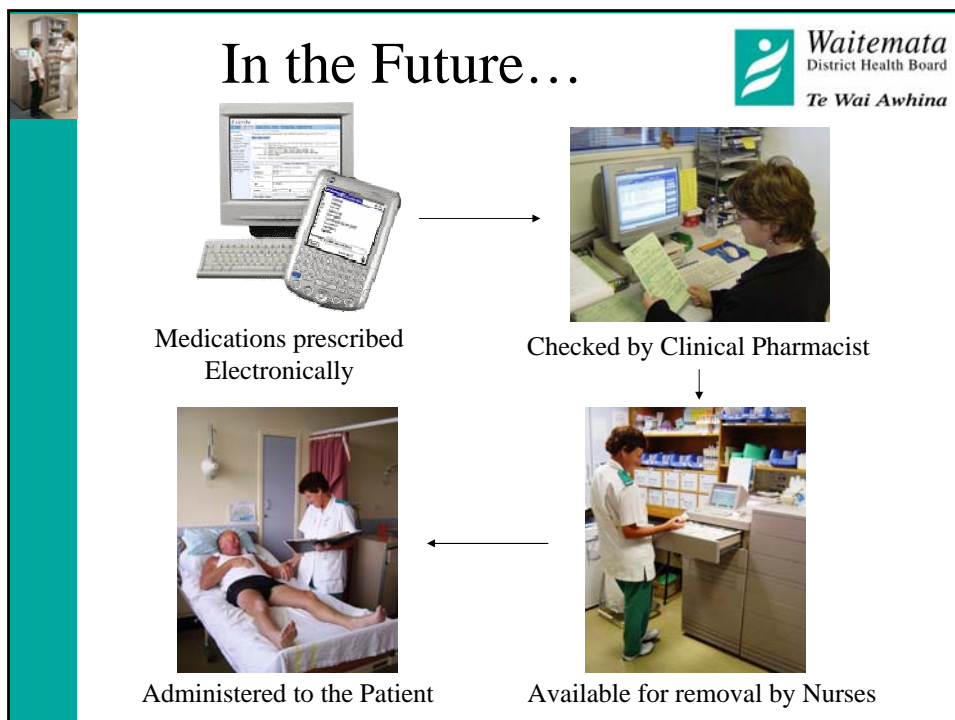
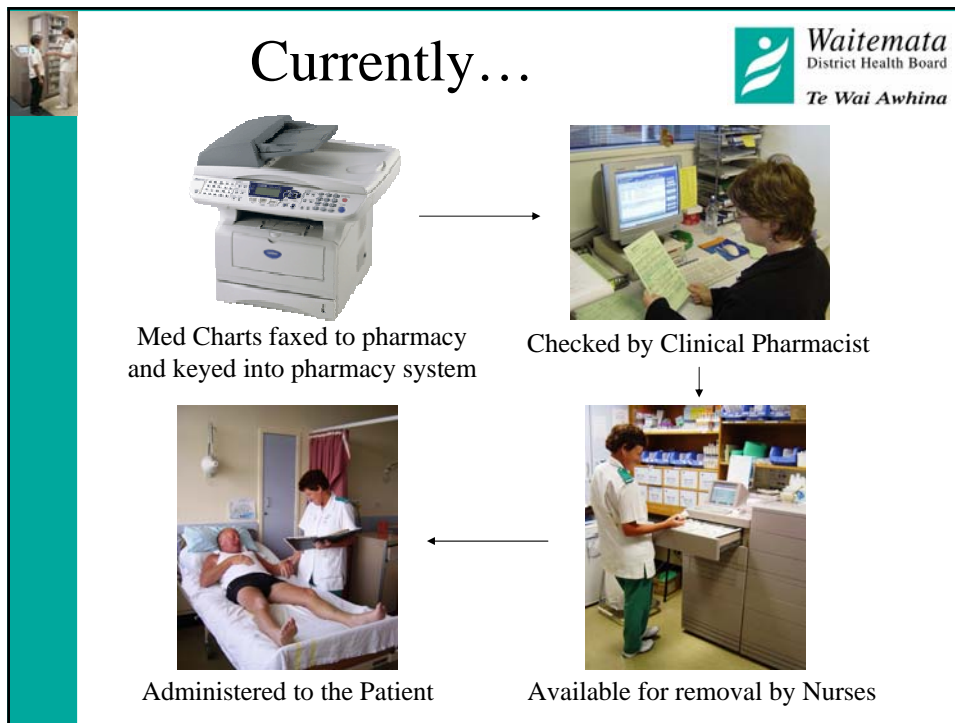




Organisation Benefits




- Building block in the shift to full electronic management of medicines
- 100% of medication costs are attributable to an individual patient
- Quality Review of clinical practice (DUE)
- Drug Utilisation Evaluation
- Costing information e.g. cost of medicines per DRG.








Financial Benefits




- **Medical Wards:**
 - Eight general medical wards
 - 19.7% decrease in medicine costs per occupied bed day.

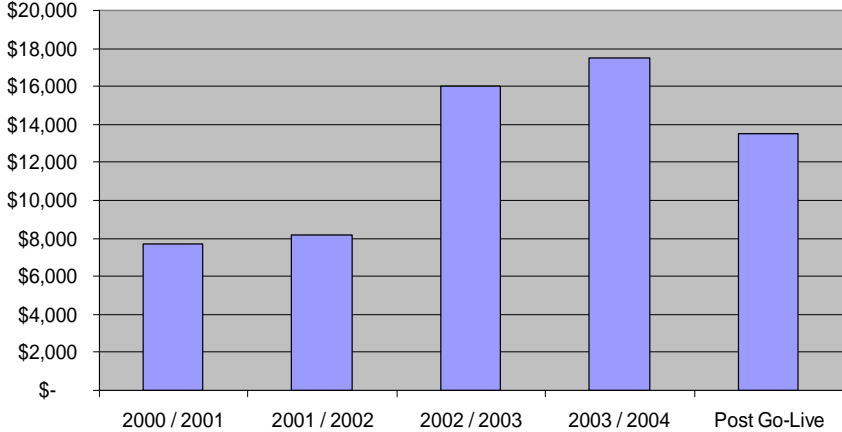
- **Surgical Wards:**
 - Two general surgical & two orthopaedic wards
 - 20.3% decrease in medicine costs per occupied bed day.



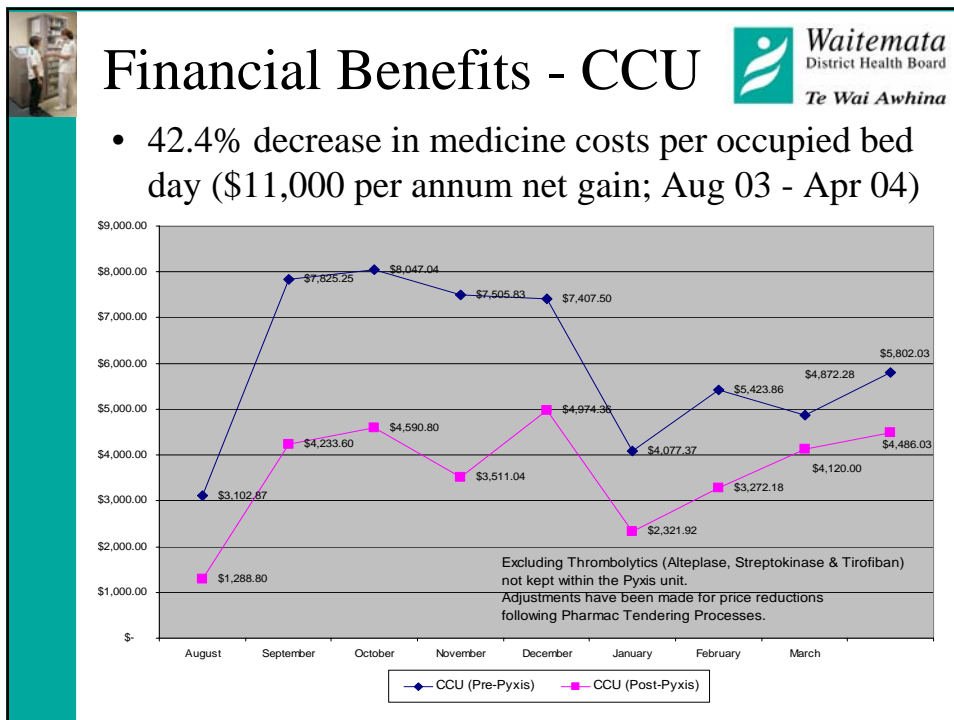
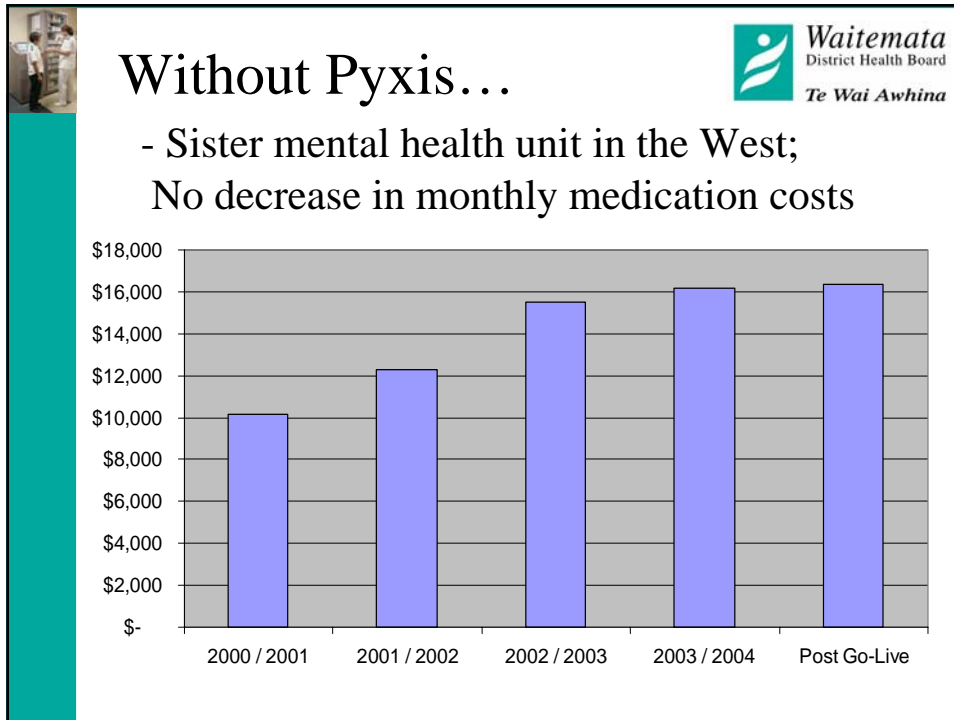
Mental Health Units




- Average monthly medication costs
19% decrease seen post-installation




Period	Average Monthly Medication Cost (\$)
2000 / 2001	~\$7,800
2001 / 2002	~\$8,200
2002 / 2003	~\$16,000
2003 / 2004	~\$17,500
Post Go-Live	~\$13,500





Financial Benefits



- Excluding the recent installation into the Emergency Department at North Shore:

\$220,000 per annum net gain after leasing costs.

- Future Installations – July / August 2005:
- Paediatric Unit & Special Care Baby Unit
- Waitakere Surgical Unit (4 x Theatres & Recovery)
- Mason Forensic Unit (5 Pyxis Units)



High Risk Medications



- Diltiazem warning message for 30mg immediate release tablets





WHICH DILTIAZEM??

PLAIN TABLETS (DILTIAZEM[®]):
Note use the diltiazem immediately and as usually administered THREE or FOUR times daily. Plain tablets MUST not be substituted for slow release preparations.




30mg tablet 60mg tablet

IF THE DOSE OF DILTIAZEM IS MORE THAN 60MG DO NOT ADMINISTER PLAIN TABLETS

SUSTAINED RELEASE CAPSULES (DILTIAZEM SR[®]):
Are a gelatin capsule filled with coated beads that release diltiazem slowly over approximately 12 to 16 hours. They are usually administered TWICE daily.




SR 90mg capsule SR 120mg capsule

CONTROLLED DELIVERY CAPSULES (CARDIZEM CD[®]):
Are a gelatin capsule filled with coated beads of differing thickness that release diltiazem slowly over approximately 24 hours. They are usually administered ONCE daily.





CD 120mg capsule CD 180mg capsule CD 240mg capsule

LONG ACTING TABLETS (DILTIAZEM LA[®]):
These contain an inert core of diltiazem surrounded by a porous membrane that releases diltiazem over approximately 24 hours. They are usually administered ONCE daily.





LA 180mg tablet LA 240mg tablet


THE SLOW RELEASE PREPARATIONS ARE NOT INTERCHANGEABLE AND MUST NOT BE CRUSHED

FOR ANY ENQUIRIES REGARDING DILTIAZEM OR OTHER MEDICATIONS, CONTACT THE INPATIENT PHARMACY ON EXTENSION 2626.

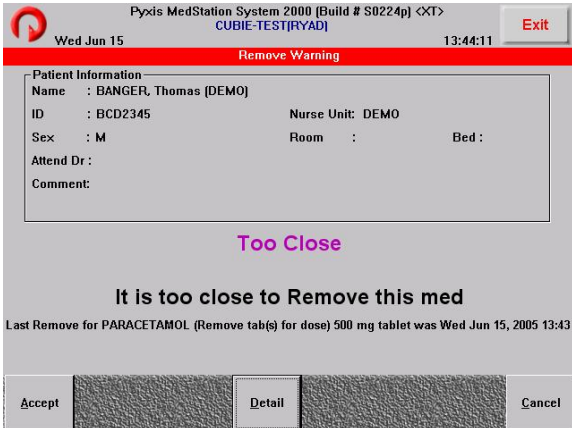
© 2005 by B. Pyxis, Waitemata District Health Board Hospital Pharmacy 0 201



“Too Close” Warnings



- Warns if an attempt is made to remove the same medication for a patient within a specified time period.




Sample Uses:


Paracetamol (4h)

Warfarin (20h)


Can override and continue to remove but asks nurse to enter a reason




High Risk Warnings



- **MUST NOT BE CRUSHED**
 - All Controlled Release preparations
 - eg: Diltiazem CD, SR & LA; Metoprolol CR;
- **DO NOT GIVE WITH CALCIUM**
 - Quinolone antibiotics (Ciprofloxacin; Norfloxacin)
- **AMIODARONE IV WARNING**
 - Use 5% Dextrose GLASS bottle & Low-sorbing giving set.
- **CALCIFEROL ADMINISTRATION**
 - Calciferol is usually administered as a STAT dose or once MONTHLY; check chart carefully before administering.
- **MUST BE GIVEN BY IM INJECTION ONLY**
 - eg: Depot Zuclopenthixol, Flupenthixol etc...



Clozapine Management



- High risk medication; bloods checked by Pharmacy weekly for patients on mental health units.
- If bloods have not been checked, still able to remove, but require TWO nurses, and are required to enter the patients blood results onto the machine before it will allow them to remove the clozapine.
- If blood results are low, prompts nurse to cancel administration and contact On-call Psych registrar or pharmacist.



High Risk Medications




- Warfarin Alert System - pharmacist aware of patients receiving warfarin on their ward.


NORTH SHORE HOSPITAL - PHARMACY PATIENT LISTING FOR WARD 3 ON 6/08/04

Rm	Patient / NHI	Age / Team	Diagnosis	Day	Intervention / Notes
A	GREEN, ANTHONY ABC1234	77 BURM	SOB	6	CO2 retainer, O2 2lt np, nebs, FBC
	Lab Results: 08/08 K+: 4.7; 08/08 Na+: 143; 08/08 Urea: 14.2**; 08/08 Cr: 0.13**; 05/08 Phos: 0.84; 08/08 ALT: 40; 08/08 ALP: 86; 08/08 AST: 47**; 08/08 GGT: 52; 05/08 Mg+: 0.89; 08/08 CRP: 33**; 05/08 Adj Ca+: 2.2; 08/08 Hb: 98**; 08/08 PCV: 0.34**; 08/08 Platelets: 259; 08/08 WCC: 9.5; 06/08 INR: 1.0; 08/08 Est. CrCl: 36 - 42 ml/min (If 60 - 70kg)				
	Profiled Medications: CILAZAPRIL TAB 0.5mg; SIMVASTATIN TAB 20mg; FLUTICASON INHALER 125mcg; ASPIRIN SOLUBLE TAB 300mg; FRUSEMIDE TAB 40mg; SALBUTAMOL NEBULE 5mg; IPRATROPIUM NEB 500mcg/2ml (20pk); SODIUM CHLORIDE AMP 0.9% (10ml); PREDNISONE TAB 20mg; AMOXICYLLIN/CLAVULANIC ACID TAB 500/125mg; THEOPHYLLINE (SUSTAINED RELEASE) TAB 350mg;				
A	RED, ANGELA XYZ7890	78 SRZII	High INR + ARF	7	IVI
	Lab Results: 09/08 K+: 4.6; 09/08 Na+: 143; 09/08 Urea: 4.1; 09/08 Cr: 0.10; 02/08 Phos: 0.88; 02/08 ALT: 02/08 GGT: 14; 02/08 Lithium: 0.7; 02/08 Mg+: 0.89; 02/08 Adj Ca+: 2.5; 06/08 Hb: 122; 06/08 PCV: 0.38; 09/08 INR: 1.9**; 09/08 Est. CrCl: 31 - 37 ml/min (If 50 - 60kg)				
	Profiled Medications: DILTIAZEM (CONTROLLED DELIVERY) CAP 120mg; ALLOPURINOL TAB 100mg; ENOXIMIC COATED TAB 100mg; CILAZAPRIL TAB 0.5mg; FLUTICASON INHALER 125mcg; SALBUTAMOL NEBULE 5mg; IPRATROPIUM NEB 500mcg/2ml (20pk); PARACETAMOL (PANADOL) TAB 500mg; POTASSIUM CHLORIDE TAB SR 600mg; SALBUTAMOL NEBULE 5mg; LACTULOSE SYRUP 10g/15ml;				





Interactions System



- Alerting system reviews all medications removed from any Pyxis machine and alerts if certain criteria are met.

***** INTERACTION BULLETIN *****


Patient: Mr C. Blue (NHI#: ABC1234)

Medication 1: Warfarin Sodium
Last Removed 12/6/05 4:06pm


Medication 2: Roxithromycin
Last Removed 13/6/05 8:44am

Pyxis Station: Ward 5 – North Shore Hospital

Severity Class: 2 (Moderately Significant)



Conclusion



- Minimised clinical risks associated with the prescribing, dispensing and administering of medicines
- Minimised expenditure on medicines by reducing wastage
- Gained efficiencies in time spent by clinical staff in managing medicines

