Digital Drugs Delivering Benefits By Connecting Care

Professor Johanna Westbrook Centre for Health Systems and Safety Research Macquarie University, Australia



Making Medicine Digital D3 Workshop London School of Economics 5th November 2015

Australian Institute of Health Innovation



Australian Institute of Health Innovation (AIHI)

Professor Jeffrey Braithwaite Foundation Director, AIHI Centre for Healthcare Resilience & Implementation Science

Professor Enrico Coiera Centre for Health Informatics

Professor Johanna Westbrook Centre for Health Systems and Safety Research

Centre for Health Systems and Safety Research

Programs of Research

- Medication Safety and e-Health
- Communication and Work Innovation
- Human Factors Evaluation and Design
- Pathology and Imaging Informatics
- Safety & Integration of Aged and Community Care Services



Research Methods Development

Digital Drugs Delivering Benefits By Connecting Care

Within an organisation Across organisations Across a country



Medication Safety and eHealth



Electronic medication management systems (eMM)

Chart Rx-Inpat	Rx-Inpatient - Mr Michael Holsworthy			
Cancel Reference Viewer Help				
Mr Michael Holsworthy (145-264H i), DOB:	12/06/1947, 57 ye	ars , 86 kg , BMI: 26 , BSA: 2.09		
Medication Search				
Name ery Search	Generics conta	aining up to 2 substances		
Ervacne	Erythromycin			
Ervc	Capsule	175mg		
Erythrocin		250mg		
🖏 Erythromycin	Gel	20mg/1g		
Erythromycin (DBL)	Infusion	1g		
🤻 Erythromycin ethyl succinate		300mg		
	Injection	1g		

Plan to rollout Cerner in 241 hospitals in NSW (pop 7.5M)

Medication errors – single most preventable cause of patient harm

5.8 prescribing errors/adm

25% of all medications administered had at least one error

2-3% of admissions are medication related Controlled Before & After study to assess if commercial e-MMS are effective at reducing medication errors







csc

2 Hospitals 2 Systems 6 wards

OPEN ORCESS Freely available online

Effects of Two Commercial Electronic Prescribing Systems on Prescribing Error Rates in Hospital In-Patients: A Before and After Study

Johanna I. Westbrook^{1*}, Margaret Reckmann¹, Ling Li¹, William B. Runciman², Rosemary Burke³, Connie Lo^{1[±]}, Melissa T. Baysari⁴, Jeffrey Braithwaite⁵, Richard O. Day⁶

January 2012 | Volume 9 | Issue 1 | e1001164





Sample: 3200 patient admissions; 17,000 prescribing errors

Prescribing errors declined by >50% (p<0.0001)

44% (p=0.0002) reduction in serious prescribing error rate 25/100 admissions → 14/100 admissions (95%CI 21-29) (95%CI 10-18)
No significant change on the control wards (p=0.4)

Effects of eMM on medication administration error rates

- Controlled pre post study
- ✤ 226 nurses administering 7451 medications on 6 wards
- Observe & record drug details- compare with charts





Post eMMS



Significant reduction on the intervention wards of 4.24 errors/100 administrations (95%CI: 0.15-8.32, *p*=0.04) compared to

control wards.

Wrong timing errors had the greatest decline by 3.35 /100 administrations

(95%CI: 0.01-6.69, *p*<0.05) compared with control wards.



Change in serious medication administration errors

Significant reduction in serious (ie potential ADEs) MAEs on intervention compared to control wards 4.20% 1.83% (95%CI 3.25, 5.15%) (95%CI 1.20, 2.46%) Pre Post

MACOUARIE



Data relates to cardiology ward in one hospital









eMM – resulted in a reduction of \$63-66 (£32) per admission

- Cardiology ward = ~\$100,000 savings p.a. due to a reduction ~ 80 ADEs p.a.
- Entire hospital with 39,000 annual admissions = releasing \$2.5M each year



New Errors !



Available at JAMIA.BMJ.Com Research and applications

The safety of electronic prescribing: manifestations, mechanisms, and rates of system-related errors associated with two commercial systems in hospitals

Johanna I Westbrook,¹ Melissa T Baysari,² Ling Li,¹ Rosemary Burke,³ Katrina L Richardson,⁴ Richard O Day^{5,6} J Am Med Inform Assoc 2013;

- Occurred frequently, but low risk of patient harm
- Most frequent type
 Incorrect selection from drop-down menus = 43%

Order sentences for: metformin

(None) 500 mg, Oral, Tab, daily after food, Administration time is a guide only: MUST taken with meals 500 mg, Oral, Tab, BD after food, Administration time is a guide only: MUST taken with meals 500 mg, Oral, Tab, TDS after food, Administration time is a guide only: MUST taken with meals 1,000 mg, Oral, Tab, daily after food, Administration time is a guide only: MUST taken with meal 1,000 mg, Oral, Tab, BD after food, Administration time is a guide only: MUST taken with meal 1,000 mg, Oral, Tab, BD after food, Administration time is a guide only: MUST taken with meal 1,000 mg, Oral, Tab, DS after food, Administration time is a guide only: MUST taken with meal 1,000 mg, Oral, Tab, BD after food, Administration time is a guide only: MUST taken with meal 850 mg, Oral, Tab, BD after food, Administration time is a guide only: MUST taken with meals 850 mg, Oral, Tab, BD after food, Administration time is a guide only: MUST taken with meals 850 mg, Oral, Tab, BD after food, Administration time is a guide only: MUST taken with meals 850 mg, Oral, Tab, SD after food, Administration time is a guide only: MUST taken with meals 850 mg, Oral, Tab, SR, evening, Administration time is a guide only: MUST taken with meals 1,000 mg, Oral, Tab, SR, evening, Administration time is a guide only: MUST taken with meals 2,000 mg, Oral, Tab, SR, evening, Administration time is a guide only: MUST taken with meals 2,000 mg, Oral, Tab, SR, evening, Administration time is a guide only: MUST taken with meals

How will digital drug information transform health care decision-making and work practices?

Success reliant upon systems integrating and supporting work and communication processes



Social Network Analysis to investigate communication

Much medication information is communicated face-to-face

Who do you seek medication advice from at least weekly on your ward?





Who Do Hospital Physicians and Nurses Go to for Advice About Medications? A Social Network Analysis and Examination of Prescribing Error Rates

Nerida Creswick, PhD* and Johanna Irene Westbrook, PhD⁺

J Patient Saf • Volume 11, Number 3, September 2015





How will eMM systems impact communication and workflow ?

Direct Observations Nurses & Doctors **MACQUARIE**



AIM: To measure changes in how nurses and doctors distributed their time across work tasks pre and post eMMS





70 nurses observed for 276.9 hours 59 doctors observed for 356.3 hours



Results – Pre Post eMM



Nurses and Doctors with eMM experienced no significant changes in % of time spent on:

- Medication Tasks;
- Direct Care;
- Professional Communication

Compared to those without eMM



Doctors with eMM spent 6% more time with other doctors (p=0.003) and patients (p=.009) compared to control ward doctors.

Nurses with eMM spent less time with doctors (p=0.0001). Both fewer (tasks per hour) and shorter interactions (mean task time)

Research and applications



Impact of an electronic medication management system on hospital doctors' and nurses' work: a controlled pre-post, time and motion study

Johanna I Westbrook,¹ Ling Li,¹ Andrew Georgiou,¹ Richard Paoloni,² John Cullen³

J Am Med Inform Assoc 2013;





Influence on team and individual decision-making processes

What impact does eMMS decision support have during ward rounds?



 48% of medication orders triggered alerts

17% read

No
 prescriptions
 changed

Research and applications



J Am Med Inform Assoc 2011;18:754-759.

The influence of computerized decision support on prescribing during ward-rounds: are the decision-makers targeted?

Melissa T Baysari,¹ Johanna I Westbrook,² Katrina L Richardson,³ Richard O Day^{4,5}

Junior doctors at night 16:30-22:30

Observational study - 65 hours

78% of those alerts were read

5% resulted in a change in prescribing

Junior doctors' prescribing work after-hours and the impact of computerized decision support

Samantha L. Jaensch^{a,b}, Melissa T. Baysari^{b,c,*}, Richard O. Day^{a,b}, Johanna I. Westbrook^d INTERNATIONAL JOURNAL OF MEDICAL INFORMATICS 82 (2013) 980–986





Paediatric patients

Delivering safe and effective care for children in hospital with eHealth systems



Aim – Assess the impact of eMM in paediatrics





Australian Government

National Health and Medical Research Council





care, advocacy, research, education

Stepped-wedge cluster randomised controlled trial (SWCRCT)



- 8 Wards will be included in the study at Site 1
- The order of wards (clusters) receiving the eMM has been randomised
- Collect data at baseline and the next 10 weeks
- By the end of the study all clusters will have the intervention.



Stepped Wedge Cluster Randomised Controlled Trial at Site 1



Prescribing errors: Measured at baseline and at each of 10 steps, totalling n=1232 admissions at end of study

Medication administrations Measured at baseline and at each of the 10 steps totalling n=2640 administrations

Clinical review to assess potential and actual harm Role of parents/caregivers

Digital Drugs Delivering Benefits

Across organisations Enabling seamless information exchange



The Case of Aged Care









Lessons from implementation of electronic medication administration records in residential aged care facilities

> Amina Tariq Andrew Georgiou Johanna Westbrook



All actors have different paper/digital views

Going Digital- Interoperability Issues



1. Pharmacy Computer View

EDIT Medication

Direction

Full Direction

osages

Prescribed As Pack Number

Frequency,

(dd/mm/yy)

Prescriber

Indication

Cautions

Route

Drug Name * SoflaxTab

2 bd

b'fast

2

Category P - Packed

Daily

Quantity 28.00

Start Date 27/02/12

2 twice daily , but giv

lunch

-

Mon

Presc. No.

.

bed

2

PRN

R

Dormant

dinner

Mon Tue Wed Thu Fri Sat Sur

End Date

(dd/mm/vv)

Patient Details There is a resident with similar or same name. Facility: Trolley: Clifford Preferred Nam Alleraies: Nil Known Medication place the tablets on her hand, give a glass of water, takes one per Notes: **Doctor Details** Doctor Name: Fax: Email: Mobile: Regular Medical ons - Packed Medications 0600 0800 1000 1200 Drug Name nstruction Route Frequency Actonel 35mg 1 weekly on 0 Once Mon 1.00 Monday,full glass Tab water remain (RisedronateNa) upright,30 mins before food O 3 times daily 2.00 PanadlOsteo665 2 three times daily, never crush mgTb this please (Paracetamol) 1.00 Perindo 2mg Tab Take one tablet O Once daily in the morning (Perindopril erbumine) HYPERTENSION /HEART Frusid20mgTab 1 in the morning, O Once daily 1.00 reduced as per (Frusemide) RMMR Ostelin 1000 Cap 1 at dinner O Once daily (Cholecalciferol)

3. Printed Chart

View

2. RACF Computer (administration) View

Admir Drug	Drug Name	Frequency	Dasa
Ø	SOFLAXTAB (CASSIA, SENNOSDB, ETC)	1 twice daily (Oral)	1
Ø	GAVISCN-PLIQ (SODIUM ALGINATE, SODIUM BICARB, CALCIUM CARBONATE)	take 10 ml three times a day after meals (Oral)	10
	<sa>KENACOMB 5G EAR/OINT (GRAMICIDIN, NEOMYCIN SULFATE, TOPICAL; NYSTATIN, T)</sa>	Apply three times a day to affected area as per faxed repeat (Topical)	1
Ø	MOVICOL (POWDER) (MACROGOL 3350,POTASSIUM CL,SODIUM BICARBON)	Dissolve the contents of one sachet in water twice a day (Oral)	1
	SPIRIVA18MCGPWDR (TIOTROPIUM BROMIDE)	inhale the contents of one capsule via handihaler daily (inhaler)	0
	FRUSID20MGTAB (FRUSEMIDE)	take 1-2 tablets in the morning when required for oedema *RN ONLY (Oral)	0
	FRUSID20MGTAB (FRUSEMIDE)	when required for oedema "RN ONLY (Oral)	0

Suboptimal integration with work

Data entry for patches at the pharmacy

How it appears in the resident's medications data

Client Medications		53	72	PATCH INTEGRITY CHECK
NEW Medicatio	n TransidermNitro25mgPatch	Other Medication Deta	73	Patch off
Direction * Full Direction	remove at 8pm	Max tab per Do Max tab per (74	Patch Removal
Dosages *	0800 1200 1700 2000	Not On C Wart 53 Variable Dr	75	Patches
Prescribed As Pack Number	1 Strenath 25mg	Existing Medications 53	76	Pulse
Category	N - Non-Packed Max. PRN/Pack	Oroxine50mcgTab COENQ10 VIT D 1000U	77	red wine
Quantity Frequency	7.00 Presc. No.	Antiox Excel Cap Panto 40mg Tab KRILL OIL CAPSULES	78	remove TrnsidermNitro25mg



Enormous potential to obtain population data regarding the medication profiles of residents

Data sources represent different meanings and language



Digital Drugs Delivering Benefits

Across a country





23.9 Million 2% of Australia's population lives in the yellow area





Personally Controlled Electronic Health Record PCEHR -



Population uptake

Electronic Health Record for every Australian went live Jul 2012

As at 2 October 2015

2,419,577 Australians with active eHealth record



PCEHR uptake by age and region





Estimated % of the population registered by remoteness area classification at 14-Jan-15

Medical Director 3.14e - [Lindsay E	Blanton]			
Note: Patient Edit Summaries	s <u>T</u> ools <u>C</u> linical Correspor	ndence <u>A</u> ssessment <u>R</u> esour	rces PCEHR <u>W</u> indow	v <u>H</u> elp
🛉 🗕 R. 🤻 🛃 🔯 🦉 🎔	🔋 🕂 🖄 🏹 🔋 😰	🖠 🞯 🕑 🦪 🞯 🕸	۵ 🖌 ۲۹ 🖻	Go MDReference
Lindsay Blanton 101 Dalys Gr. Mundiwindi. Wa 6753 Allergies: ELASTOPLAST, GLUTEN, H SULFONAMIDES, TRIMETH Wamings: Summary R. Current R. S Family History No known issues	DOB: 01/10/1991 Ph: 03 87 Ph: 03 87 Progress Past history	21 yrs Occupation: 745 4544 (home) Record No: ISH, Pension No: Smoking Hx: Results Letters	Trade IHI No: ATSI: 10 Daily Documents Old so	25m 4s 8003 6086 6667 0989 Neither Aboriginal nor Torres Strait Islander Recalls I scripts Imm. Social History Long working hours, active socially, poor eating habits
Past History				Immunisations
Year Date (Condition	Side		Date Immunisation
1986 05/1986 4 1990 1/12/1990 0 1999 AUG 1999 4 2010 NOV10 4 2011 1/2/11 4 2012 02/01/2012 4 2013 17/05/2013 1	Throat infection Asthma Glandular fever Asthma - Frequent Episodic Deafness - industrial Atrial Fibrillation Hypercholesterolaemia Ischaemic heart disease Tonsillitis			16/05/2007 H-B-VAX II(ADULT) 04/06/2007 RABIES 09/08/2010 DIPHTHERIA 09/05/2012 BOOSTRIX 15/02/2013 DTPA
Medications				Preventive health
Drug name	Strength Dose	Freq Instructions		Item
AMOXIL CAPSULE IPRATROPIUM BROMIDE (ANHYDR. VENTOLIN CFC-FREE INHALER	250mg 21mcg/spray 2-4 Sprays 100mcg/dose 1-2 Puffs	ti.d. m.d.u. q.4.h. m.d.u.		Counselling re:Smoking Cessation should be considered! Pneumococcal Disease vaccination is recommended! Diphtheria-and-tetanus-containing vaccination is recommended!



BLANTON, Lindsay (Mr) DoB 1-Oct-1991 (21y)	Shared Health Summ 22-Aug-2013 SEX Male IHI 8003	6086 6667 0989		
	START OF DOCUMENT			
HCN Samples Database Author Dr Alfonso Terri-Anne (General Medical 02 9897 1212 Adverse Reactions	Practitioner)			
Substance/Agent	Manifestati	on		
SULFONAMIDES	Not s	stated		
NITRATES	• Hive	s, Rhinitis, Asthma compli	cations	
edications				
Drug name	Strength	Dose	Freq	Instructions
AMOXIL CAPSULE	250mg			
PRATROPIUM BROMIDE (ANHYDR	21mcg/spray	2-4 Sprays	t.i.d.	m.d.u.
/ENTOLIN CFC-FREE INHALER	100mcg/dose	1-2 Puffs	q.4.h.	m.d.u.
Medications				
	tions	Clinical Indication		
Medication Direct		Hay fever		
Medication Direct IPRATROPIUM BROMIDE (ANHYDROUS) Nasal 2-4 S Spray 21mcg/spray 2-4 S	prays t.i.d. m.d.u.			
Medication Direct IPRATROPIUM BROMIDE (ANHYDROUS) Nasal 2-4 Stream of the second sec	prays t.i.d. m.d.u. Puffs q.4.h. m.d.u.	Asthma		



- Moving from paper-based medication information can produce many benefits - reduced errors and improved medication management.
- Challenges in terms of the representation of information and associated meanings, with implications for the exchange of information and interoperability of systems and also 'trust'.
- Medication decision making processes are complex, dynamic and influenced by multiple contextual factors