

Evaluation of an antimicrobial stewardship program in
an Australian tertiary paediatric hospital

Mona Mostaghim

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Certificate of Original Authorship

I, Mona Mostaghim declare that this thesis, is submitted in fulfilment of the requirements for the award of Doctor of Philosophy, in the Graduate School of Health - Discipline of Pharmacy at the University of Technology Sydney. This thesis is wholly my own work unless otherwise referenced or acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

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Mona Mostaghim

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Abbreviations

ACSQHC	Australian Commission on Safety and Quality in Health Care
ADE	Adverse drug event
ADR	Adverse drug reaction
AMH-CDC	Australian Medicines Handbook-Children's Dosing Companion
AMS	Antimicrobial stewardship
AMR	Antimicrobial resistance
ANZPID	Australia New Zealand Paediatric Infectious Diseases Society-Antimicrobial Stewardship Interest Group
APR-DRG	All Patient Refined Diagnosis-Related Group
ARPEC	Antimicrobial resistance and prescribing in European children
ATC	World Health Organization Collaboration Centre for Drug Statistics Methodology Anatomical Therapeutic Chemical classification
AURA	Antimicrobial Use and Resistance in Australia
BNF	British National Formulary
BSA	Body Surface Area
BSI	Blood stream infection
CAP	Community-acquired pneumonia
CEC	Clinical Excellence Commission
CDC	United States Centers for Disease Control and Prevention
CDI	<i>Clostridium difficile</i> infection
CDSS	Computerised decision support and approval system, computerised clinical decision support system, computerised antimicrobial approval and decision support system
CICU	Children's intensive care unit
CPOE	Computerised prescriber order entry
DDD	Defined daily dose
DOT	Days of therapy
DTC	Drug and Therapeutics Committee
ED	Emergency Department
EMR	Electronic medical records
ESBL	Extended-spectrum beta-lactamase producing bacteria
FN	Febrile neutropenia
FTE	Full time equivalent

g	Grams
HO	Hospital-onset or hospital acquired
HSCT	Haemopoietic stem cell transplant
ICD-10-AM	International Statistical Classification of Diseases and Related Health Problems Australian Modification 10th Revision
ICU	Intensive Care Unit
ID	Infectious Diseases
IDSA	Infectious Diseases Society of America
IT	Information Technology
IV	Intravenous
JMO	Junior medical officer
LHD	Local health district
LOS	Length of stay
LOT	Length of antimicrobial therapy
MRO	Multidrug-resistant organism
MRSA	methicillin-resistant <i>Staphylococcus aureus</i>
NAPS	National antimicrobial prescribing survey
NIMC	National In-patient Medication Chart
NSQHS	National Safety and Quality Health Service
NICU	Neonatal intensive care unit
NSW	New South Wales
NWAU	National weighted activity unit
OBD	Occupied bed-day
OR	Odds ratio
PD	Patient bed-days
PICU	Paediatric intensive care unit
PBS	Pharmaceutical Benefits Scheme
PPS	Point Prevalence Survey
QI	Quality improvement
SS	Specific Syndrome
SSTI	Skin and soft tissue infection
TDM	Therapeutic Drug Monitoring
TGA	Therapeutic Goods Administration
WHO	World Health Organization
5x5	The 5x5 Antimicrobial Audit

Original Peer-Reviewed Manuscripts Generated Through This PhD Research

The follow people and institutions contributed to the publication of work undertaken as part of this thesis:

Candidate: Mona Mostaghim^{1,2}

Other authors: Beata V. Bajorek ¹, Thomas Snelling^{3,4,5}

1. Graduate School of Health, University of Technology Sydney, NSW, Australia
2. Pharmacy Department, Sydney Children’s Hospital, NSW, Australia
3. Department of Infectious Diseases, Princess Margaret Hospital for Children, Western Australia, Australia
4. Wesfarmers Centre of Vaccines & Infectious Diseases, Telethon Kids Institute, University of Western Australia, Western Australia, Australia
5. Menzies School of Health Research, Charles Darwin University, Northern Territory, Australia

Signatures of authors:	Mona Mostaghim	Production Note: <u>Signature removed prior to publication.</u>
	Beata V. Bajorek	Production Note: <u>Signature removed prior to publication.</u>
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Abstract

Background: The rise of antimicrobial resistance has been described as a threat to human health. Judicious use of antimicrobials, through antimicrobial stewardship (AMS) is a key component of the World Health Organization's Global action plan on antimicrobial resistance. AMS programs involve multiple strategies to ensure optimal antimicrobial selection, dosage, route of administration and duration of therapy to maximise the benefit of antimicrobials, whilst minimising the associated collateral damage. Although AMS has been a requirement for hospital accreditation in Australia since 2013 implementation and evaluation of AMS in Australian tertiary paediatric hospitals has been limited by the complexities in the patient population, and the local infrastructure and resources.

Aim: Evaluate an AMS program in an Australian tertiary paediatric hospital

Methods: The Centers for Disease Control and Prevention core elements of AMS for hospitals provided a framework for six studies, two studies focused on the use of the local computerised decision support and approval system (CDSS). The CDSS was assessed as an intervention to reduce inappropriate broad-spectrum antibiotic use for community-acquired pneumonia, compliance with the CDSS and its utility as a tracking tool were explored in a second study. Educational needs of nursing and non-consultant medical staff were determined using two different survey approaches. Candidate units of measure for antimicrobial surveillance were

developed and used to evaluate the impact of AMS in the paediatric intensive care setting in a quasi-experimental design study.

Results: Children with suspected uncomplicated community-acquired pneumonia were predominantly prescribed guideline-concordant narrow-spectrum penicillins at admission to hospital both before and after CDSS implementation. CDSS use was uncommon after standard pharmacy and AMS working hours, with ongoing implications for AMS involvement the next standard working day. Broad-spectrum antibiotics, potentially suitable for long term trend analysis were identified. Both standard adult defined daily doses and vial-based estimates did not identify an association between implementation of the CDSS and a reduction in restricted antibiotic use.