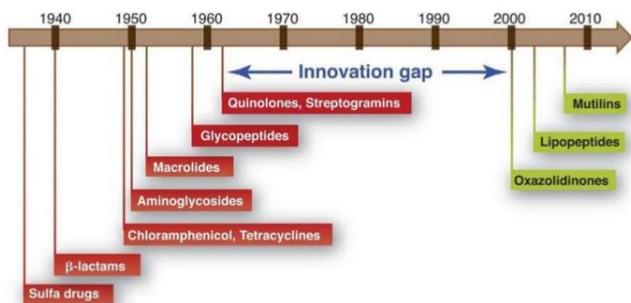


Antimicrobial Resistance and Antimicrobial Stewardship

Resistance to antimicrobial drugs is a major threat to human health. Most of the classes of antimicrobials in use today were developed in the 1940s - 1960s, and few new agents are on the horizon (Fig. 1). It is essential that we optimise the use of existing antimicrobial drugs to help contain resistance and improve patient care.

Fig 1: Timeline for introduction of antibiotic classes

Between 1962 and 2000, no major classes of antimicrobials were developed (innovation gap)



Fischbach MA, Walsh CT. Science 2009;325(5944):1089

Antimicrobial resistance

Antimicrobial resistance is the ability of an organism to withstand an antimicrobial to which it was originally sensitive. It is a natural evolutionary phenomenon that is driven by two key human actions:

- inappropriate use of antimicrobials
- poor infection control

Antimicrobial resistance is a major issue overseas and is becoming a significant problem here (Fig. 2). The prevalence of methicillin resistant *Staphylococcus aureus* (MRSA) has doubled across NZ over the past decade¹. In Canterbury, there has been increase in identification of isolates of multidrug resistant Extended Spectrum Beta Lactamase (ESBL) producing organisms² and a recent outbreak of vancomycin resistant enterococci (VRE).

Fig 2: Multidrug resistant *Pseudomonas aeruginosa* in a urine culture from a patient who arrived in a South Island hospital from overseas

Urine culture:	(1)	>100 x 10 ⁶ /L	PSEUDOMONAS AERUGINOSA
			(1)
	Trimethoprim		R
	Ampi/Amoxicillin		R
	Amoxicillin/clavulanic		R
	Cefaclor		R
	Nitrofurantoin		R
	Ciprofloxacin		R
	Ceftriaxone		R
	Cefoxitin		R
	Cefepime		R
	Ceftazidime		R
	Tazobactam/piperacillin		R
	Gentamicin		R
	Tobramycin		R
	Amikacin		R
	Imipenem		R
	Meropenem		R
	Ertapenem		R
	Colistin/Polymyxin		S

The health implications of increasing antimicrobial resistance are great. Individuals infected with multidrug resistant organisms are more likely to die. They are sicker for longer making them harder to treat, and there is more chance for spread. The presence of resistant organisms may also compromise health gains like surgery and cancer chemotherapy leading to an increase in morbidity. Costs are increased as patients infected with multidrug resistant organisms often require more expensive drugs and longer treatment courses.

Inappropriate antimicrobial use

Antimicrobial resistance correlates with the quantity of antimicrobials used and the duration of treatment. Up to 50% of antimicrobial use within hospitals may be inappropriate and can result in

- under treatment of the original infection
- direct drug toxicity
- acquisition of multiresistant organisms
- development of *Clostridium difficile*
- increased length of hospital stay

Antimicrobial Stewardship (AMS)

AMS helps optimise antimicrobial use through facilitating appropriate choice of drug, dose and duration of treatment as well as route of administration (see the antimicrobial creed – below). This may involve guideline development, audit, education and clinical patient review. CDHB has a strong history of promoting appropriate antimicrobial use through activities such as guideline development (reviewed and published annually in the Pink Book) and audit. In October 2013, an AMS pharmacist was employed to help co-ordinate and advance the AMS programme for CDHB. The introduction of such programmes elsewhere has been associated with benefits such as reduction in *C. difficile* infections and improvement in local resistance patterns.

The antimicrobial creed – MIND ME

- M** microbiology guides therapy wherever possible
- I** indications should be evidenced-based
- N** narrow spectrum required
- D** dosage appropriate to the site and type of infection
- M** minimise duration of therapy
- E** ensure monotherapy in most situations

Therapeutic Guidelines "Antibiotic" v 14, 2010, Melbourne, Australia

Summary

Resistant organisms are becoming more common and new antimicrobials with novel modes of action are not on the horizon. Antimicrobial stewardship aims to help optimise antimicrobial use and encourage all of us to help preserve existing antimicrobial agents for future use.

References 1. Heffernan H, Bakker S. Environmental Science & Research, Jul 2013; 2. Creighton J (pers. comm.), Canterbury Health Laboratories, Nov 2013;