Walking the Tightrope

A Critical Analysis of Rheumatic Fever Prevention Protocol

A Balancing Act In a High Risk Community

Ora Toa Poriuua

Annie Judkins
Post Code Penicillin

Colour Code Cefalexin

Area Code Amoxil
<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Total number of eligible (Māori, Pacific, NZDep quintile 5) 4-19 year olds (index case only) presenting to rapid response service</td>
</tr>
<tr>
<td>2</td>
<td>Total number of eligible 4-19 year olds given antibiotics the same day assessed</td>
</tr>
<tr>
<td>3</td>
<td>Percentage of eligible (M, P, Q5) 4-19 year olds given antibiotics the same day assessed</td>
</tr>
<tr>
<td>4</td>
<td>Total number given oral amoxicillin once daily</td>
</tr>
<tr>
<td>5</td>
<td>Total number given intramuscular single dose benzathine benzylpenicillin</td>
</tr>
<tr>
<td>6</td>
<td>Total number given twice daily oral erythromycin</td>
</tr>
<tr>
<td>7</td>
<td>Total number given other antibiotics</td>
</tr>
<tr>
<td>8</td>
<td>Percentage given appropriate antibiotics</td>
</tr>
</tbody>
</table>

**Eligible household contacts (3-35 years old with a sore throat)**

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>Total number of eligible household contacts (3-35 years old with a sore throat) assessed</td>
</tr>
<tr>
<td>10</td>
<td>Total number of eligible household contacts given antibiotics the same day assessed</td>
</tr>
<tr>
<td>11</td>
<td>Percentage of eligible household contacts given antibiotics the same day assessed</td>
</tr>
<tr>
<td>12</td>
<td>Total number given oral amoxicillin once daily</td>
</tr>
<tr>
<td>13</td>
<td>Total number given intramuscular single dose benzathine benzylpenicillin</td>
</tr>
<tr>
<td>14</td>
<td>Total number given twice daily oral erythromycin</td>
</tr>
<tr>
<td>15</td>
<td>Total number given other antibiotics</td>
</tr>
<tr>
<td>16</td>
<td>Percentage given appropriate antibiotics</td>
</tr>
</tbody>
</table>

---

1  Appropriate antibiotics for high risk population with a sore throat are: Amoxicillin once daily, one dose of intramuscular benzathine benzylpenicillin, twice daily erythromycin.
828 Throat Swabs in 2 years

- GAS Pos: 18%
- Gp C&G: 4%
- GAS Neg: 78%
Throat Swabs by Month and Results

- Number of Swabs
- GAS Pos
- Gp C&G
- GAS Neg

The graph shows the number of throat swabs conducted and the results for GAS, Gp C&G, and GAS Neg over the months from July 2016 to June 2018.
Throat Swab Result and Treatment as per Guidelines

- Number GAS Pos
- No GAS Pos treated as per Guidelines
- Number GAS Neg
- Neg Swabs Given Abs
62% GAS Negative Swabs treated with ABs
“...As with Q2 it appears there have low numbers of eligible individuals presenting to the sore throat management services and also given same day antibiotics. Can you advise what more is being done to promote awareness of sore throat management services and ensuring appropriate antibiotics are being given...”
RF in Wellington 2016 -> now

- 2016 = 10 cases, 7<16 & 3 adults
- 2017 = 9 cases, 6 <16 & 3 adults
- Year to date = 8 cases, 4<16 & 4 adults
It is used to measure the Minimum Inhibitory Concentration [**MIC**] of an antimicrobial agent, which is the lowest concentration of antimicrobial agent which will inhibit the growth of microbes.
* Penicillins need to have the MIC above 40-60% of the time to be effective

* 3-4 times daily to maintain this MIC level

* Amoxicillin once daily does not achieve this!
What does a 32 kg 4 year old girl have in common with antibiotic metabolism with a 102 kg 18 year man?

* 32 kg
What are the risks?

- Bacterial Adaptation
- Antibiotic Resistance
- People NOT presenting when there is a true risk
- Losing Trusting Relationship
Challenge Everything

- CVR
- Smoking Status Recording
- Institutionalised Racism
- Crap Housing and Poverty
- EBM
Do Your Best

- Advocate for your Patients
- Prescribe Antibiotics thoughtfully
- We are only here for a short time, but our actions could affect generations.
Antimicrobial Resistance (AMR): A heads up on the threat

Speakers: David Holland on behalf of Infection Services, CMH and HARC
Bryan Betty
Annie Judkins
Several major reports in recent years and media interest...
antibiotic resistance potentially threatens the safety and efficacy of surgical procedures and chemotherapy
Objectives and priority areas for action

There are five objectives that address priority areas for action on AMR.

1. **Awareness and understanding**: Improve awareness and understanding of antimicrobial resistance through effective communication, education and training.

2. **Surveillance and research**: Strengthen the knowledge and evidence base about antimicrobial resistance through surveillance and research.

3. **Infection prevention and control**: Improve infection prevention and control measures across human health and animal care settings to prevent infection and the transmission of micro-organisms.

4. **Antimicrobial stewardship**: Optimise the use of antimicrobial medicines in human health, animal health and agriculture, including by maintaining and enhancing the regulation of animal and agriculture antimicrobials.

5. **Governance, collaboration and investment**: Establish and support clear governance, collaboration and investment arrangements for a sustainable approach to countering antimicrobial resistance.
Development of AMR:

- Darwinian Evolution
- Selective pressure
- Survival of the fittest $\rightarrow$ spread

Antibiotic effectiveness

Resistant bacterial spread

Antibiotic Use
The hammer: Antibiotic prescribing

In NZ about 85-90% human antibiotics prescribed in the community and 10-15% in hospital
Inappropriate antibiotic prescribing approximately 50% in both settings
The anvil: **Spread** of resistant organisms

- Locally generated
- Introduction from elsewhere ‘pre-prepared’
An outbreak of Carbapenem-Resistant Organisms in Burns Patients in a critical care complex.
Index Patient (A)

- 68 Male
- Sailor
- Boat explosion – burns – 85% TBSA superficial – deep
- Transferred for further specialized burn care from overseas hospital

On admission:

Blood culture set:
Bottle flagged by Bact/ALERT software

CULTURE:

ANAEROBIC BOTTLE:
After less than one days incubation, Organism (1)
BOTH BOTTLES:
After less than one days incubation, Organism (2)

(1) Providencia stuartii isolated
**This isolate is positive for a new carbapenemase.**

(2) Pseudomonas aeruginosa isolated

<table>
<thead>
<tr>
<th>Antibiotic</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amoxycillin</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>Amox/Clav</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>Aztreonam</td>
<td>S</td>
<td></td>
</tr>
<tr>
<td>Cefuroxime</td>
<td>R</td>
<td></td>
</tr>
<tr>
<td>Cefoxitin</td>
<td>R</td>
<td></td>
</tr>
<tr>
<td>Gentamicin</td>
<td>R</td>
<td>S</td>
</tr>
<tr>
<td>Cotrimoxazole</td>
<td>R</td>
<td></td>
</tr>
<tr>
<td>Ciprofloxacine</td>
<td>I</td>
<td>S</td>
</tr>
<tr>
<td>Cefazidime</td>
<td>R</td>
<td>S</td>
</tr>
<tr>
<td>Ceftriaxone</td>
<td>R</td>
<td></td>
</tr>
<tr>
<td>Cefepime</td>
<td>I</td>
<td>S</td>
</tr>
<tr>
<td>Tazocin</td>
<td>R</td>
<td>S</td>
</tr>
<tr>
<td>Amikacin</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>Meropenem</td>
<td>R</td>
<td></td>
</tr>
<tr>
<td>Tigecycline</td>
<td>R</td>
<td></td>
</tr>
<tr>
<td>Ertapenem</td>
<td>R</td>
<td></td>
</tr>
</tbody>
</table>

R = Resistant    S = Susceptible    I = Intermediate

Strict infection control and isolation Fashioned a treatment
Quick primer of Carbapenems

- Beta-lactams (kind of)
- Extremely broad spectrum
- Extensive evidence of efficacy & safety
- Tolerated in severe penicillin allergy
- 1st-line treatment for serious infections with multi-resistant GNBs eg ESBLs (extended spectrum beta-lactamase producers)

**Examples:**
- Meropenem
- Imipenem
- Ertapenem
Carbapenemase-Producing Enterobacteriaceae (CPE)

- *Enterobacteriaceae*
- Plasmid-mediated enzyme producers
  - Spreads very easily
  - Linked with multiple other resistances
- ‘Super-ESBL’ organisms that are resistant to their primary treatment

→ Major clinical & public health concern
Quick guide to CRO terminology

**Enterobacteriaceae:**
- E.coli
- Klebsiella pneumoniae
- Proteus
- Enterobacter cloacae
- Citrobacter
- Serratia marcescens
- Morganella morganii
- Providencia
- Salmonella, Yersinia, Shigella, and many others...

**CRO**
Carbapenem Resistant Organism

**CRE**
Carbapenem Resistant Enterobacteriaceae

**CPE***
Carbapenemase Producing Enterobacteriaceae

- NDM
- KPC
- Oxa-48
- Etc...

[other]
[other]
Great concern: Limited rx options = poor outcomes

<table>
<thead>
<tr>
<th>‘Typical’ E.coli</th>
<th>‘Wild-type’</th>
<th>ESBL</th>
<th>CPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amoxicillin</td>
<td>?</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Augmentin</td>
<td>✓</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Cefuroxime</td>
<td>✓</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Ceftriaxone</td>
<td>✓</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Co-trimoxazole</td>
<td>✓</td>
<td>?</td>
<td>x</td>
</tr>
<tr>
<td>Ciprofloxacin</td>
<td>✓</td>
<td>?</td>
<td>x</td>
</tr>
<tr>
<td>Gentamicin</td>
<td>✓</td>
<td>?</td>
<td>x</td>
</tr>
<tr>
<td>Amikacin</td>
<td>✓</td>
<td>✓</td>
<td>?</td>
</tr>
<tr>
<td>Carbapenems</td>
<td>✓</td>
<td>✓</td>
<td>x</td>
</tr>
</tbody>
</table>

- Colonisation
  - Asymptomatic, but can transmit
  - Community spread is known
- Infection
  - Just like any other GNB infection...
  - ...except limited treatment options
  - High mortality & morbidity (~50% from bacteraemia)

- Healthcare costs
- ?Impact on elective treatments
Patient B (27 Dec)

SITE: CVL later in blood culture

BACTERIAL COUNT: 100-1000 colony forming units.

CULTURE:

(1) *Providencia stuartii* isolated
**This isolate is positive for a NDM carbapenemase.**

<table>
<thead>
<tr>
<th>Antibiotic</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amoxicillin</td>
<td>R</td>
</tr>
<tr>
<td>Amox/Clav</td>
<td>R</td>
</tr>
<tr>
<td>Cefuroxime</td>
<td>R</td>
</tr>
<tr>
<td>Cefoxitin</td>
<td>R</td>
</tr>
<tr>
<td>Gentamicin</td>
<td>R</td>
</tr>
<tr>
<td>Cotrimoxazole</td>
<td>R</td>
</tr>
<tr>
<td>Ciprofloxacin</td>
<td>R</td>
</tr>
<tr>
<td>Ceftazidime</td>
<td>R</td>
</tr>
<tr>
<td>Cefttriactone</td>
<td>R</td>
</tr>
<tr>
<td>Amikacin</td>
<td>S</td>
</tr>
</tbody>
</table>

R = Resistant  S = Susceptible  I = Intermediate

Cross-Transmission!
IC discussions/investigations/interventions
Patient C (2 Feb)

Blood culture set:
Bottle flagged by BacT/ALERT software

CULTURE:

After less than one days incubation,

\(1\) **Klebsiella pneumoniae isolated**

**This isolate is positive for a NDM carbapenemase.**

This isolate has a plasmid-mediated AmpC beta-lactamase.

\(1\)

<table>
<thead>
<tr>
<th>Antibiotic</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amoxycillin</td>
<td>R</td>
</tr>
<tr>
<td>Amox/Clav</td>
<td>R</td>
</tr>
<tr>
<td>Cefoxitin</td>
<td>R</td>
</tr>
<tr>
<td>Gentamicin</td>
<td>R</td>
</tr>
<tr>
<td>Cotrimoxazole</td>
<td>R</td>
</tr>
<tr>
<td>Ciprofloxacin</td>
<td>I</td>
</tr>
<tr>
<td>Ceftazidine</td>
<td>R</td>
</tr>
<tr>
<td>Ceftriaxone</td>
<td>R</td>
</tr>
<tr>
<td>Cefuroxime</td>
<td>R</td>
</tr>
<tr>
<td>Tazocin</td>
<td>R</td>
</tr>
<tr>
<td>Amikacin</td>
<td>S</td>
</tr>
<tr>
<td>Fosfomycin</td>
<td>S</td>
</tr>
</tbody>
</table>

R = Resistant      S = Susceptible      I = Intermediate
So what can we do?

Prevention and control of carbapenemase-producing organisms at a regional burns centre

St Andrew’s Centre for Plastic Surgery and Burns, Chelmsford, UK

Discussion

CPOs generated a good deal of interest on the unit and became a topic discussed on daily ward rounds and at all staff meetings. Nevertheless, in the early stages of patient A’s admission, we encountered the phenomenon: “It doesn’t mean me.”

Key learning points from this experience include:

- need to perform basic tasks properly;
- effective cleaning of the environment;
- effective hand hygiene between and before each patient contact;
- effective decontamination of each item of equipment going from one patient to another.

These fundamental principles must be observed by all staff at all times, ensuring organizational confidence that, when admitting patients with both resistant and susceptible organisms, we are taking every measure to prevent the spread of those organisms.
How is it spread?

*CRO will not jump, skip, hop or fly!*

**Contact** with infected/colonised people, mostly via:

- Hands
- Shared Equipment
- Environmental/surfaces
Timeline of Burns patients in ICU & OT:
A tale of two transmissions

**PATIENT A**
- Admission 11 Dec
- Blood cultures positive on admission
carbapenem resistant *P. stuartii*
- Multiple tissue and blood cultures positive
  Five different CRO
- 68M Sailor. Not NZ. Burned in boat explosion. Transfer from
  overseas hospital. 85% supf

**PATIENT B**
- Admission 27 Dec
- Bacteraemic
- Vascular catheter tip then tissues and blood cultures *P. stuartii*
- Very stormy course, several positive blood cultures, tissue cultures
  Transmission of resistance element to other organisms. Given
  novel antibiotic regimen
- Discharged 23 April

**PATIENT C**
- Admitted 17 Jan
- 7F NZer. Flame injury 40%
- 2 February: tissues *P. stuartii*
  and *K. pneumoniae*. NDM and
  BC
- Ischaemic bowel
- Prolonged bacteraemia with CRO and Candida
  eventually recovered and discharged home with support

OUTBREAK declared

Multiple multi-team IC discussions/investigations/interventions
Finding a Source

All patients in ICU

All patients in OR4

All have the same consulting team

Urgent Action Plan ICU

Reinforced isolation room practice and SP
Screening post Bioquell
Aspirated sink and sanitizer
Ventilation checked
Restricted equipment into room
Restricted patient movement
Discharge and residual screening
Staff flow refined

Urgent Action Plan Theatre

Testing water, ventilation, mister, dermatome versus
New guidelines provided
Education to all parties
Inform other DHBs, comm to staff, media
Flag alert all 122 patients through OR4
Processes reviewed, burns CPE outbreak literature search
50 initial swabs of OR4 and weekly thereafter
Close theatre 4 to other patients

New Processes ICU and Theatre
Current state of play.....

• Continue to define and refine

• No single source identified (as often the case in literature)

• Vigilance over the next several months

• Audits/projects for hand hygiene compliance and environmental cleaning commenced
What's happening globally and in NZ?
Global carbapenem resistance: Dark is bad
Global resistance and risk: travellers can acquire

Figure 1: Percentages of travellers that acquired β-lactamase-producing Enterobacteriaceae per subregion, according to the United Nations geoscheme.


Increase in resistance may be rapid

Figure 1. Percentage of invasive *K. pneumoniae* isolates with resistance to carbapenems, EU/EEA, 2014 [5]

Note: EARS-Net data are based on invasive isolates from blood and cerebrospinal fluid only. Bacteria isolated from other sites of infection or colonisation are not included.
CPE in NZ 2009-2017

Note: Multiple, distinct CPE isolates from the same patient are included, but duplicate isolates of the same species with the same type(s) of carbapenemase(s) from the same patient are excluded. In 2017, there were eight CPE isolates that carried the genes encoding for both NDM and OXA-48-like carbapenemases. These eight isolates are counted in the number of isolates for both these carbapenemase classes.

Source: ESR surveillance
Outbreak studies of CRO bacteraemia have reported mortality rates of 40-60%
Summary: coming to a MSU near you

• Antimicrobial Resistance produced by antibiotics; need to use judiciously
• Once develop, resistant organisms (local or introduced) can spread rapidly compounding problem
• Control strategies for community as well as hospital will be very important. National Guidelines
• Take home: If you come across one – call for help!
Acknowledgements & Questions

- Infection Control Team
- ICU staff
- Operating Theatre staff
- Management & Incident Control team
- Infectious Diseases
- Microbiology
- Pharmacy
- Special Thanks to Rachael Hart and Christopher Hopkins for some slides
Keep antibiotics working

Winter 2018

Bryan Betty, Deputy Medical Director
GP Cannons Creek East Porirua
Our objective

“…to secure for eligible people in need of pharmaceuticals, the **best health outcomes** that are reasonably achievable from pharmaceutical treatment and **from within the amount of funding provided.**”

- *New Zealand Public Health and Disability Act 2000*
PHARMAC’s role
Our consumption is high

Figure 1: Antibiotic consumption of 29 European countries and New Zealand, 2013, expressed as defined daily doses (DDD) per 1,000 population per day

Prescribing by seasons – what’s driving prescribing behavior?
Drivers for antibiotics

- Psychology/neuroscience - humans make EMOTIONAL decisions
- Higher the emotions = more irrational the behaviour
- If we understand behavioural drivers, we can change behaviour
The core emotion associated with health is anxiety.

Anxiety:

- roadblocks our ability to hear
- hinders our ability to understand and accept messages
- creates irrational behavior
Consumers attitudes to health and antibiotics

• Need for speed – fix me fast, fix me now (it’s about fixing, not recovery)

• Drugs and technology will do this

• Antibiotics are more like panadol than a significant medicine

• Lack of shared understanding with my Health Professional around when antibiotics are necessary
Prescribers’ views and experiences

• I may give backpocket prescriptions if patients demand antibiotics

• I feel pressure to prescribe, even if that’s unnecessary, because I don’t want patients to get sicker

• I’m aware of the dangers of antibiotic resistance, but it’s a bigger problem overseas than in NZ

• I’m aware that my peers and I may overprescribe antibiotics

• I’m not always able to discuss antibiotic resistance with patients
Current behavior dynamic

CONSUMERS

• Understand value of antibiotics
• Some awareness of antibiotic resistance, but don’t feel it’s important to me
• Want a quick fix
• View antibiotics as a safe, quick-fix treatment

PRESCRIBERS

• Aware of antibiotic resistance, but don’t feel it’s something I can influence
• Lack of time or narrative to change expectation for an antibiotic prescription
• Therefore, I prescribe antibiotics

These are behaviors we need to disrupt
The behaviour dynamic we want

CONSUMERS

• Awareness and understanding of antibiotic resistance
• Advocates for the message - help ‘spread’ the idea
• Balanced view of antibiotic use

PRESCRIBERS

• Motivated to help spread information about antibiotic resistance
• Reduce prescribing antibiotics

This is an idea that can be spread
Together we can

KEEP ANTIBIOTICS WORKING
Printed posters

**ANTIBIOTICS WON'T FIX YOUR COLD OR FLU**

The best treatment is plenty of rest, fluids and relief of your pain and symptoms.

Colds and flu can't be fixed with antibiotics, because they're a viral infection. Antibiotics only work on infections caused by bacteria.

We need to use antibiotics carefully, or they'll stop working.

Always take your doctor, nurse or pharmacist's advice on using antibiotics.

www.keepantibioticsworking.nz

**MOST EARACHES NEED PAIN RELIEF NOT ANTIBIOTICS**

A check is always best. Your doctor will look inside your child’s ears and tell you if antibiotics are the right treatment.

Antibiotics don't help most ear infections get better any faster. Pain relief medicines (like paracetamol and ibuprofen) will help your child feel more comfortable.

Always take your doctor, nurse or pharmacist's advice on using antibiotics.

www.keepantibioticsworking.nz
YOUR FAMILY & ANTIBIOTICS
WHAT YOU NEED TO KNOW

Antibiotics aren’t always the best treatment for some common infections. In fact, they can’t fix a virus like a cold or flu, and are not usually needed to treat most ear infections.

We need to use antibiotics carefully, or they’ll stop working.

Overusing antibiotics, especially when we don’t need to, is causing antibiotic resistance – when bacteria get better at defending themselves, and our antibiotics don’t work as well.

Over time, antibiotics could stop working when we need them to, putting people’s lives at risk. It’s a global health threat, and we all need to help keep antibiotics working.

Colds & Flu

Most cold and flu symptoms clear by themselves in 7 to 10 days. It’s a good idea to stay home from work or school when you are feeling most unwell, are sneezing or coughing often, or you have a very runny nose.

The 5 best ways to treat a cold or flu:

- **Rest**
  - Rest is best to help your immune system fight the virus. Stay home if you need to.

- **Fluids**
  - Drink plenty of fluids (water is best) to keep your body well hydrated.

- **Decongestants**
  - A decongestant tablet or nasal spray may help relieve a runny or blocked nose.

- **Lozenges & gargles**
  - Sucking on a throat lozenge or gargling several times a day with warm salt water (1/2 tsp of salt in 1 cup water) can soothe a sore throat. Gargle for about 30 seconds and spit out.

- **Pain relief**
  - Take regular paracetamol or ibuprofen to relieve any aches and pains or reduce a fever.

Earache

Ear infections are very common in young children, especially during or just after a cold. Antibiotics won’t help most ear infections get better any faster in children under 2 years old. That’s why most earaches need pain relief, not antibiotics. Rest, cuddles, time at home, and pain relief medicines (like paracetamol and ibuprofen) will help relieve a fever, any pain or discomfort, and help your child feel better.

Your doctor might want to recheck your child’s ears around 6-12 weeks later to make sure any fluid in the ears has gone.

Stop colds & flu spreading

- Catch coughs and sneezes in the crook of your arm, or with a tissue. Throw the tissue into the bin, and wash your hands afterwards.
- Wash your hands often, with soap, for 20 seconds, and dry them well afterwards.
- Clean kitchen and bathroom surfaces regularly.
- Stay home and away from others when you’re most sick.

For more information:

www.keepantibioticsworking.nz
www.healthline.govt.nz

You can call Healthline free 24 hours a day: 0800 611 116
In an emergency, visit your local hospital or call 111.

Always take your doctor, nurse or pharmacist’s advice on using antibiotics.
Example of Facebook posts

- Fighting a cold or flu and looking for a fast fix? Here's why antibiotics won't do the job.
- Cold or Flu got the better of you? What you can do to get on the mend fast.
- Cold or Flu got you down? What you can do to get better faster.

---

Why antibiotics won’t fix your cold or flu.
Find out what will work.

Fixes that really work.
Find them here.

Cold & flu fixes that actually work!
Doctor's best remedies.
Resources for primary care

Why are we using antibiotics as placebos?

Antibiotic prescribing challenges
Date Published: Wednesday, June 13, 2018 - 07:32
Duration: 26:53
Download MP3 File

Professor Bruce Arroll talks about antibiotic use, the prescribing challenges that GPs face and updates antibiotic use. Bruce is a professor at the department of General Practice and Primary Health Care at the University of Auckland. He also works in clinical practice at Greenstone Family Clinic in South Auckland.

Cold season: managing without antibiotics
For the majority of people with upper respiratory tract infections symptomatic treatment will offer better outcomes than antibiotics,

Antibiotics: the future is short
In general, the recommended durations of antibiotic treatment regimens are decreasing as evidence for the safety and efficacy of shorter courses accumulates.
How to print or order campaign resources

• Visit www.pharmac.govt.nz and search “Keep antibiotics working”
Questions