A case study of arrogance and complacency.

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It was always going to be the Titanic…..MDRO

- Arrogance: having or revealing an exaggerated sense of one's own importance or abilities.

- Complacency: a feeling of smug or uncritical satisfaction with oneself or one's achievements.

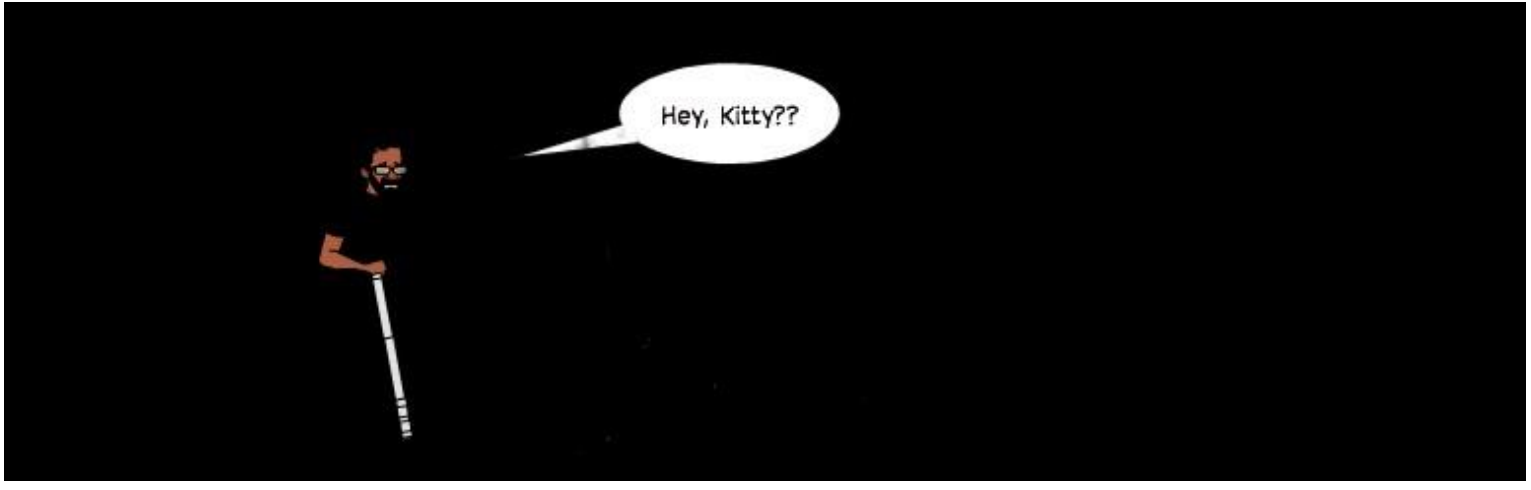
WHO – better late than never???

- WHO noticed - Antimicrobial resistance threatens the very core of modern medicine and the sustainability of an effective, global public health response to the enduring threat from infectious diseases.
- Systematic misuse and overuse of antibiotics in human medicine and food production have put every nation at risk.
- Few replacement products are in the pipeline.
- Without harmonized and immediate action on a global scale, the world is heading towards a post-antibiotic era in which common infections could once again kill.
- Alert to this crisis, the May 2015 World Health Assembly adopted a global action plan on antimicrobial resistance, which outlines five objectives:

5 Steps to a wonderful world

- Improve awareness and understanding of antimicrobial resistance through effective communication, education and training;
- Strengthen the knowledge and evidence base through surveillance and research;
- Reduce the incidence of infection through effective sanitation, hygiene and infection prevention measures;
- Optimize the use of antimicrobial medicines in human and animal health;
- Develop the economic case for sustainable investment that takes account of the needs of all countries, increase investment in new medicines, diagnostic tools, vaccines and other interventions.

Reminiscent of……



Too late – already gone….

Antibiotic Resistance

DRUG	INTRODUCTION	APPEARANCE OF RESISTANCE
Penicillin	1943	1946
Streptomycin	1945	1959
Tetracycline	1948	1953
Erythromycin	1952	1988
Vancomycin	1956	1988
Meticillin	1960	1961
Ampicillin	1961	1973
Cephalosporins	1964	late 1960's

What are MDROs?

- MDROs are predominantly bacteria, but can also include viruses, fungi, or parasites

- Most commonly Multi-Drug Resistant Organisms are bacteria that have developed resistance to one or more classes of antibiotics

- These antibiotics can no longer be used effectively to control or kill the bacteria

- Names of some MDROs identify resistance to only one drug agent, but they are frequently resistant to multiple drugs

  : MRSA (Methicillin-resistant *Staphylococcus aureus*)

  : VRE (Vancomycin-resistant *Enterococci*)

Clinical importance of MDROs

- In most instances, MDRO infections have clinical manifestations that are similar to infections caused by susceptible pathogens.
- However, options for treating patients with these infections are often extremely limited.
- Although antimicrobials are now available for treatment of MRSA and VRE infections, resistance to each new agent has already emerged in clinical isolates.
- Similarly, therapeutic options are limited for ESBL producing isolates of gram-negative bacilli

Clinical importance of MDROs

- Treatment limitations may influence antibiotic usage patterns
- Suppression of normal flora
- Creation of a favorable environment for development of colonization when exposed to potential MDR pathogens (i.e., selective advantage).
- Leading to….
  - Pain and suffering
  - Increased patient length of stay, costs, and mortality

Clinical importance of MDROs

- The type and level of care influence the prevalence of MDROs.
- ICUs, especially those at tertiary care facilities, may have a higher prevalence of MDRO infections than do non-ICU settings
- Levels in the community e.g. nursing/residential homes, are probably greatly underestimated and remain a potent reservoir for hospital infections

The most challenging MDROs in Healthcare

- Methicillin-resistant *Staphylococcus aureus* (MRSA)
- Vancomycin-resistant *enterococcus* (VRE)
- Extended-spectrum beta-lactamase-producing bacteria (ESBLs)
- Carbapenem-resistant *enterobacteriaceae* (CRE)
- Multi-drug resistant *Acinetobacter baumanii* (MDR-A)
- *Clostridium difficile* – the consequence of the ccc's
- Neisseria gonorrhoeae – the consequence of stupidity

It could only get worse…CRE

- Carbapenem antibiotics (ertapenem, imipenem, meropenem, and doripenem) are often used as the last line of treatment for infections caused by resistant Gram-negative bacilli
- Over the past decade, the Enterobacteriaceae family of bacteria have begun to develop resistance to carbapenems and these resistant bacteria have spread throughout the world and New Zealand. Bacteria include
  - Klebsiella spp., especially *K. pneumoniae*
  - *E. coli*
  - Enterobacter spp.
- **CRE** refers to carbapenem-resistant Enterobacteriaceae

CRE: Just Another Type of MDRO?

What makes CRE special…

- Decolonization strategy poor, if impossible, to implement
- Very few treatment options available, if any
- High mortality rate (50% or greater in some studies)
- Resistance can hop between many species (there are over 70 bacteria in the Enterobacteriaceae family)
- High speed/rate of resistance transfer

CRE Case Definition

- **Nonsusceptible** to one of the following carbapenems: doripenem, meropenem, or imipenem AND

- **Resistant** to all of the following third-generation cephalosporins that were tested: ceftriaxone, cefotaxime, and ceftazidime.
(Note: All three of these antimicrobials are recommended as part of the primary or secondary susceptibility panels for Enterobacteriaceae)

  - Klebsiella species and *Escherichia coli* that meet the CRE definition are a priority for detection and containment in all settings; however, other Enterobacteriaceae (e.g., Enterobacter species) might also be important in some regions.

  - For bacteria that have intrinsic imipenem nonsusceptibility (i.e., *Morganella morganii,* Proteus spp., Providencia spp.), requiring nonsusceptibility to carbapenems other than imipenem as part of the definition might increase specificity.

What can we do about it ???

Stop

And

Think

Prevent Antimicrobial Resistance

Prevent Infection

1. Vaccinate
2. Get the catheters out

Diagnose and Treat Infection Effectively

3. Target the pathogen
4. Access the experts

Use Antimicrobials Wisely

5. Practice antimicrobial control
6. Use local data
7. Treat infection, not contamination
8. Treat infection, not colonization
9. Know when to say “no” to vancomycin
   Stop treatment when infection is cured or unlikely
10. Ensure antibiotic course completed

Prevent Transmission

11. Isolate the pathogen
12. Break the chain of contagion – hand hygene

Get the catheters out!

Catheters and other invasive devices are the # 1 exogenous cause of hospital-onset infections.

Actions:

use catheters only when essential

use the correct catheter

use proper insertion & catheter-care protocols

remove catheters when not absolutely essential

Diagnose & Treat Infection Effectively
Target the pathogen

Appropriate antimicrobial therapy saves lives.

Actions:

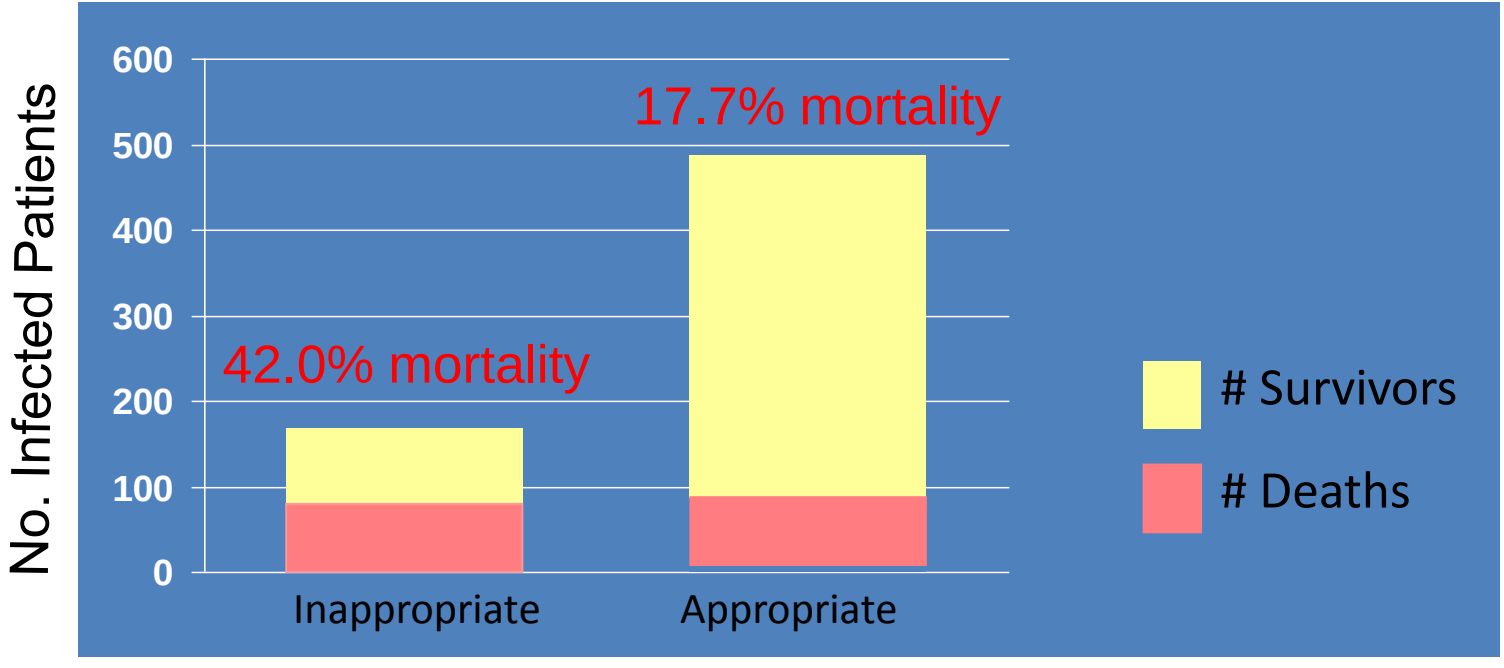
Perform culture on the patient when required and appropriate

target empiric therapy to likely pathogens and local antibiogram

target definitive therapy to known pathogens and antimicrobial susceptibility test results

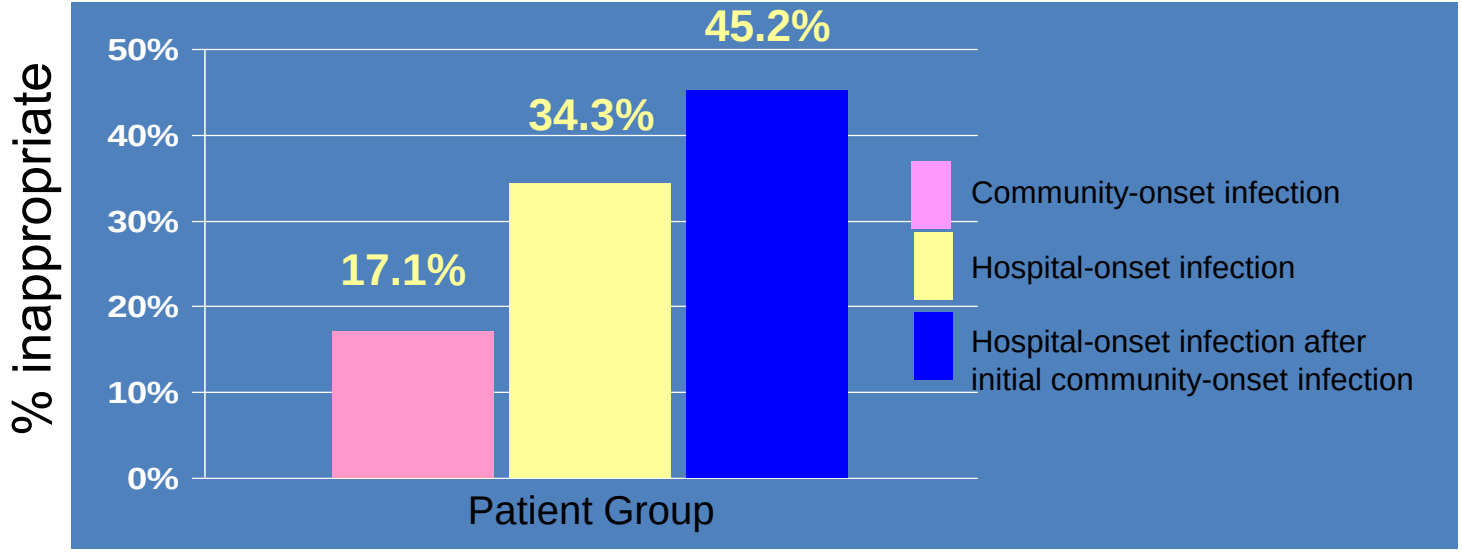
Inappropriate Antimicrobial Therapy
Impact on Mortality

Relative Risk = 2.37
(95% C.I. 1.83-3.08; p < .001)



Inappropriate Antimicrobial Therapy Prevalence among Intensive Care Patients

Inappropriate Antimicrobial Therapy
(n = 655 ICU patients with infection)



MDROs: Public Health

In a recent study conducted at a university hospital in Switzerland, researchers found

- 86% of 35 hospital kitchen raw chicken samples were positive for extended-spectrum beta-lactamase (ESBL)-producing Enterobacteriaceae (ESBL-PE), predominately *E. coli*
- 100% of 30 supermarket samples were positive for ESBL-PE
- No prepared hospital food demonstrated ESBL PE

How can we control the spread of MDROs?

- Most importantly – THINK (again)
- Control spread through correct hand hygiene procedures and appropriate PPE…..
- Wear disposable gloves and possibly gowns when applicable
- Only use antibiotics when they are needed and as directed – and then HOPE.
- Use common sense and best practice to ensure best patient outcome

Self-Reported Factors for Poor Adherence with Hand Hygiene

- Handwashing agents cause irritation and dryness
- Sinks are inconveniently located/lack of sinks
- Lack of soap and paper towels
- Too busy/insufficient time
- Understaffing/overcrowding
- Patient needs take priority
- Low risk of acquiring infection from patients
- Adapted from Pittet D, *Infect Control Hosp Epidemiol* 2000;21:381-386

Good preparation and appropriate PPE……but

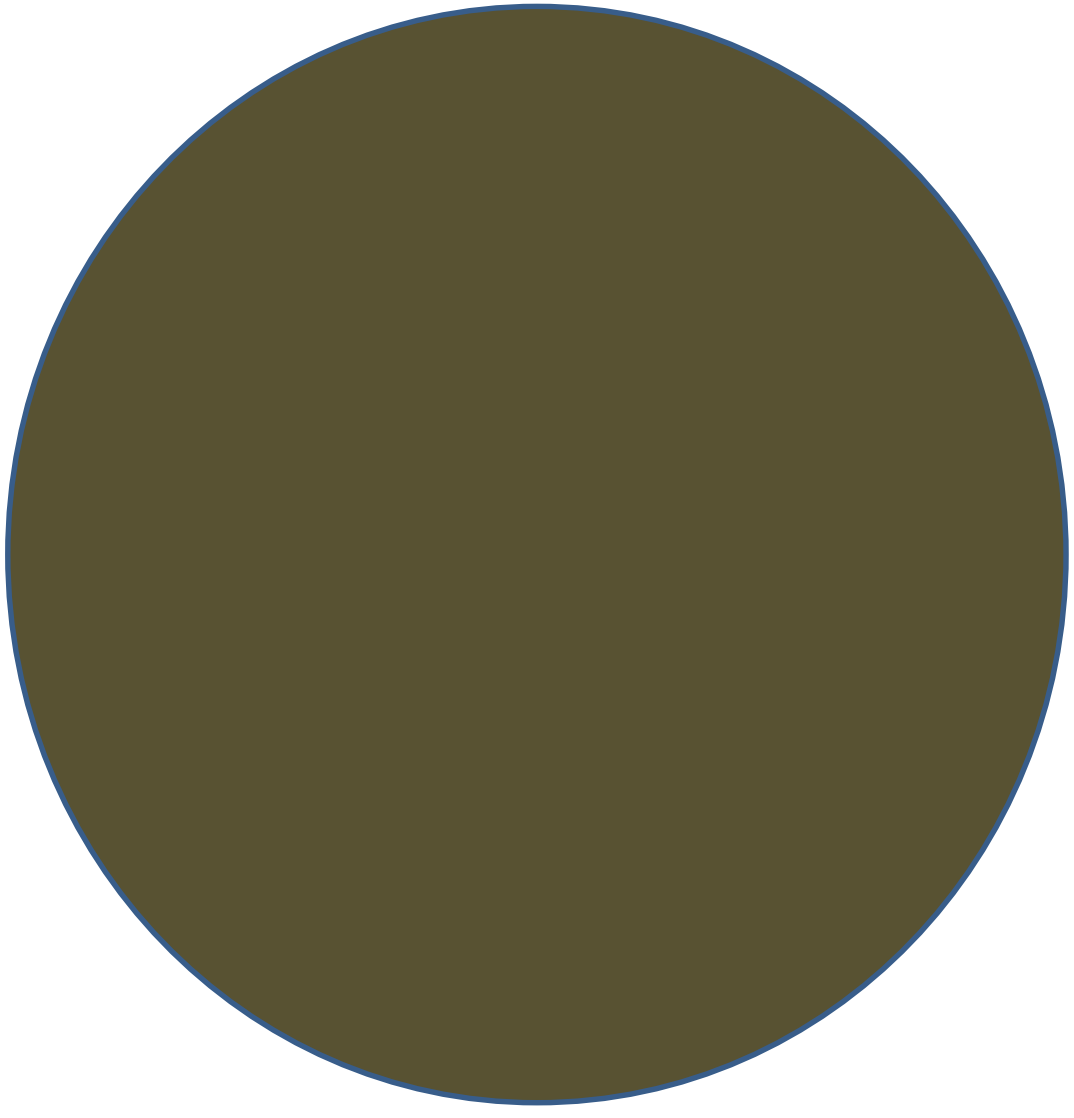
Accidents can happen – some contamination is obvious

Some contamination is harder to see – if at all.

- As in the case of Norovirus

Viral Shedding

- Primarily in stool, but also in vomitus
- Occurs for at least 2-3 weeks
- Peaks 4 days after exposure
  - 10^{10} viral copies/gram of faeces
  - May persist after symptoms resolve
- Infectious dose: 18 viral particles
- Can survive 12 hours on a surface, 12 days in contaminated fabric. A study demonstrated survival for 61 days in well water.
- How much do you need to get infected???



Infective dose
viral particles
Large spot (1ml)
=1,000,000,000
viral particles

Small spot =
0.00005ml
= 50,000 virus
(2000 x more
than you need
to get infected)

↓

You know what to do in the toilet to stay safe – what about at work.