



"One can think of the middle of the twentieth century as the end of one of the most important social revolutions in history, the virtual elimination of infectious diseases as a significant factor in social life" ¹⁹⁶²

Sir Frank MacFarlane Burnet Director of the Walter and Eliza Hall Institute of Medical Research 1960 Nobel Prize co-winner in Physiology or Medicine

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"Unless we act to protect these medical miracles, we could be heading for a post-antibiotic age"

2001

Gro Harlem Brundtland WHO Director-General

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Antimicrobial Stewardship

"Antimicrobial stewardship programs in hospitals seek to optimize antimicrobial prescribing in order to improve individual patient care as well as reduce hospital costs and slow the spread of antimicrobial resistance."

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	Microbes	Humans	Microbes by factor
# on Earth	5 x 10 ³¹	7 x 10 ⁹	~ 10 ²²
# cells in a Human	5 x 10 ¹³	5 x 10 ¹²	~ 5 - 10
Mass - kg	5 x 10 ¹⁹	3 x 10 ¹¹	$\sim 10^8$
Generation time	30 min	30 years	~ 5 x 10 ⁵
Time on earth, years	3.5 x 10 ⁹	4 x 10 ⁶	$\approx 10^3$





Salvarsan

- The Magic Bullet
 - 1910 Paul Ehrlich
 - Arsenic based
 - First chemical compound to cure a disease
 Syphilis







Penicillin

- Alexander FlemingDiscovered 1928
- Howard Florey & Ernst Chain
 - Purified and mass produced
 - Introduced 1942













US Antibiotic Usage

- Much is unknown
- Humans
 - $\blacksquare \sim 120$ million outpatient & ~ 50 million inpatient Rx/y $\blacksquare \sim 3$ million lbs/y
- Animal agriculture
- ~ 24.6 million lbs/y

Source: Mellon, M, et al, Hogging It, Estimates of Antir Union of Concerned Scientists, January 2001



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What's the Harm?

- Resistant organisms shed into environment:Through food chain
 - Direct contact &/or contamination of water and fields
- Resistant organisms include:
 - Salmonella, Campylobacter, Klebsiella pneumoniaie, Enterococcus faecium, Escherichia coli (ESBL), MRSA

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Antibiotic Misuse

- Not needed
- Continued longer than necessary
- Wrong dose
- Broad spectrum instead of narrow
- Wrong Ab chosen

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What's the Harm? The Individual

- Antibiotic use may be associated with:
 - Cost
 - Side effects
 - C. difficle infection
 - Colonization/infection with resistant organism

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C. difficile Antibiotic exposure is most important risk factor for *Clostridium difficile* associated disease (CDAD) Up to 85% of patients with CDAD had antibiotic exposure in the 28 days before infection "Epidemic" strain (NAP-1/BI) of *C. difficile*Resistant to flouroquinolones

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Individual Antibiotic Resistance

- Antibiotic use → resistance of urinary/respiratory bacteria to those antibiotics
- Antibiotics may impact on bacterial resistance for up to 12 months
- The greater the number or duration of antibiotic courses prescribed in the previous 12 months, the greater the likelihood that resistant bacteria will be isolated from patient

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What's the Harm? The Collective

Cost for Rx

- 50% inappropriate
- ↑ morbidity & mortality from resistant organisms
 ↑ costs from treating these infections
- We all may need an antibiotic one day...











Inpatient 50% Unnecessary

- Pt may appear to have (or possibly have) infection treatable by antibiotics
 - Pneumonia, Urinary tract infection
- Lack of knowledge:
 - Unnecessary duplication of therapy
 - Overly broad spectrum

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Outpatient Strategies

- No "magic bullet"
- Small changes with:
 - Guidelines, didactic educational meetings, peer review

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Outpatient Strategies

- Bigger changes with:
 - Interactive workshops, educational outreach, MD reminders
 - Multifaceted intervention with education to MDs, patients, general population
 - Delayed prescriptions

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Antimicrobial Stewardship Team

- ID specialist
- Clinical PharmD with ID training
- Clinical microbiologist
- Information system specialist
- Infection control preventionist
- Hospital epidemiologist



Core Strategies

- Prospective audit with intervention & feedbackAcademic detailing when order is received
 - Documented significant reductions in use and cost savings
- Formulary restriction and preauthorization requirement
 Have stopped *C. dificile* outbreaks
 - Led to short-term increased susceptibilities among GN pathogens
 Long-term beneficial impact not established

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Supplemental Strategies

- Education
 - Essential element, marginally effective by itself
- Guidelines and clinical pathways
 Incorporation of local resistance patterns helps
- Antimicrobial cycling
- Insufficient data
- Antimicrobial order forms
 - Automatic stop orders and MD justification

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Supplemental Strategies

- Streamlining or de-escalation of therapy
 Narrowing Rx based on Cx results
- Dose optimization
 - Individualize dose for patient/condition
- Parenteral to oral conversion
 - Earlier changes \rightarrow faster discharge
- Computer assistance
 - Provides patient-specific data at point of care

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NJDHSS

- New Jersey Careful Antibiotic Use Strategies and Education (NJ CAUSE)
 - Multidisciplinary task force 2005
 - Strategic plan to combat antimicrobial resistance
 - 5 Focus areas

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