Antibiotic Stewardship: All Good Things In Moderation

Dick Zoutman, MD, FRCPC
Professor & Chair
Division of Infectious Diseases and of Medical Microbiology
Queen's University at Kingston

Hosted by Paul Webber
paul@webbertraining.com

www.webbertraining.com

- "The war against infectious diseases has been won."
  - Dr. William Stuart, U.S. Surgeon General, 1969

Sobering Thoughts

- The earth is 5 billion years old and bacteria have been around for 4 of those 5 billion years!
- Antibiotics are the only class of therapeutic agents that effect the environment.
- Infectious diseases are still the most common cause of death worldwide.

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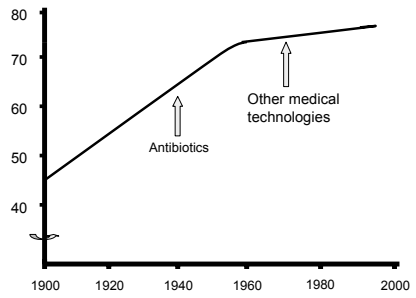
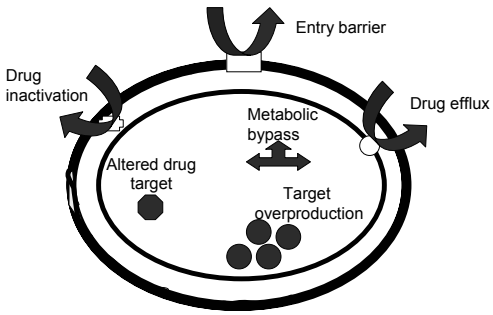
Estimated Life Expectancy at Birth



National Vital Statistics Report (1999)

Biochemical Mechanisms of Antimicrobial Resistance



Antibiotics and Mechanisms of Resistance

ß-lactams	B-lactamases, altered PBP, efflux
Macrolides	MLS, efflux
Aminoglycosides	AME, permeability
Flouoroquinolones	altered topoisomerases, efflux
Tetracyclines	efflux, altered target
Chloramphenicol	CAT, efflux
Sulfonamides	altered dihydropteroate synthase
Trimethoprim	altered dihydrofolate reductase
Vancomycin	bypass pathway
Streptogramins	MLS, efflux, enzyme modification
Rifampicin	altered target

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Genetics of Antimicrobial Resistance

- Genetic diversity
  - nucleotide substitution, DNA rearrangements and gene acquistion
- Gene acquisition
  - transformation, transduction and conjugation
- Mobile genetic elements
  - gene cassettes
  - integrons
  - insertion sequence elements and transposons
  - plasmids

Why Are Resistant Infections Happening?

- Enormous biomass of microorganisms
- Genetic plasticity
- Antibiotics are microbial products, organisms have seen them before!
- *Excessive antibiotic use
- World wide travel
- *Lax infection control practices

*Fixable

What Can We Do?

- Keep aware
- National/Provincial Surveillance Programs
- Get to know your microbiology lab
  - Expect rapid turn around times
  - Appropriate susceptibility test reporting
- Infection Control in the office & hospital
- Decrease antibiotic prescriptions for viral URI's by half!
- Improve communication with patients

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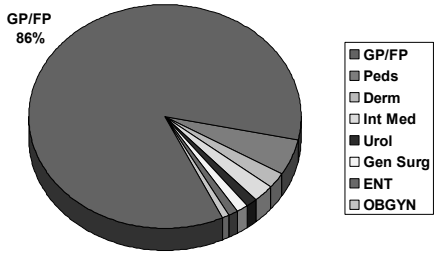
Who's Prescribing Antibiotics?



Based upon IMS Canada Data
A total of 26,277,325 antibiotic prescriptions

Decreasing Incidence of Resistant Strains is Possible

- Finnish study 1991-1994: Seppala et al. NEJM August 1997
- National program to reduce erythromycin utilization decreased use from 2.4 to 1.4 doses/1000 population
- Commensurate drop in erythromycin resistant group A Streptococci throughout the nation

Factors Affecting Antibiotic Decisions

Doctors as Pushers?

Patients as Junkies?

Or Just Lousy Communications?

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Introduction

- Antibiotics are often prescribed against indication for upper respiratory tract infections (URTIs) by physicians in Canada, the US and around the globe
- And when antibiotics are indicated, the use of first line choices is often low

Objective

- To identify and quantify the determinants of antibiotic prescribing for upper respiratory tract infections (URTIs) for both physicians and patients in family practice.

Long Term Goal

- To develop and implement target interventions to improve antibiotic use for URTIs in family practice.

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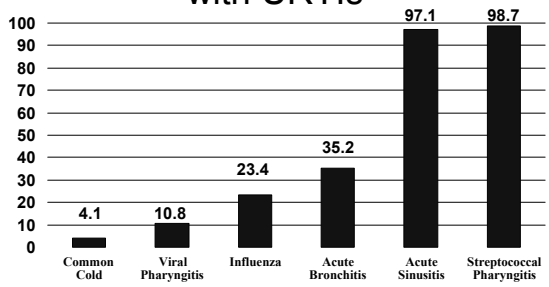
Physician Survey

- 316 southeast Ontario family physicians surveyed
- Comprehensive survey concerning antibiotic prescribing practices for URTIs
- Relative importance of factors was tested with indication for antibiotic and antibiotic choice by multiple logistic regression analyses

Antibiotics Generally Prescribed for Healthy Adults with URTIs



Factors Predictive of the Prescribing of Antibiotics for Viral URTIs

➔ Physician knowledge deficits re: indication for antibiotic for viral URTIs (OR 30.3)
➔ Patient has outside obligations (OR 3.5)
➔ Fee-For-Service remuneration (OR 3.3)
➔ Physician desire to act (OR 2.5)
➔ Lower levels of satisfaction with knowledge of antibiotic usage for URTIs (OR 1.8)
➔ Participation in fewer university-sponsored CME courses (OR 1.4)
R-squared = 0.35

Factors Predictive of Not Choosing First Line Antibiotics

➔ Regular meetings with pharmaceutical sales representatives (OR 2.1)
➔ Ascribing less importance to guidelines from medical authorities (OR 1.9)
➔ Concerns about patient co-morbidity (OR 1.9)
➔ Not being Certified by the College of Family Physicians of Canada (OR 1.8)
➔ Greater physician age (OR 1.4)
R-squared = 0.13

Conclusions Drawn From FAAD Physician Survey

- Medical knowledge and information sources were factor categories having the greatest quantitative influence on antibiotic prescribing practices for URTIs

Patient Survey

- 313 southeast Ontario patients surveyed
- Comprehensive survey concerning consult for URTI, motivation for consult, symptoms, interaction with physician, treatment received, and knowledge of antibiotics and URTIs
- Relative importance of factors was tested with indication for antibiotic and antibiotic choice by multiple logistic regression analyses

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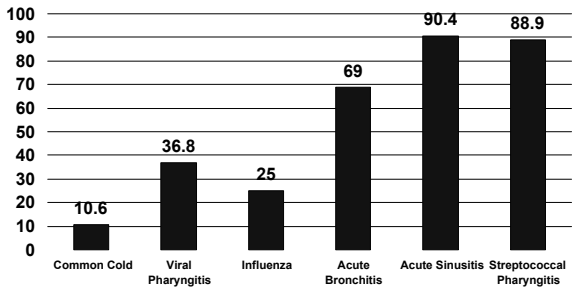
Antibiotics Prescribed for Adults with URTIs



Factors Predictive of Patient Receiving Antibiotic for Viral URTI

➔ Patient expectations for antibiotic (OR 11.6)
➔ Patient did not receive over-the-counter recommendation and or non-antibiotic prescription (OR 8.1)
➔ Greater patient age (OR 1.6)

Factors Predictive of Patient Not Receiving First Line Antibiotics

- If patients presented with wheezing, they were less likely to receive a first line antibiotic (OR 12.6)

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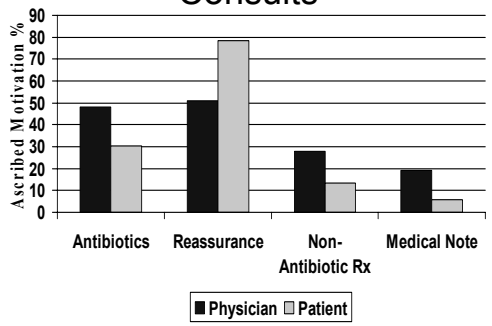
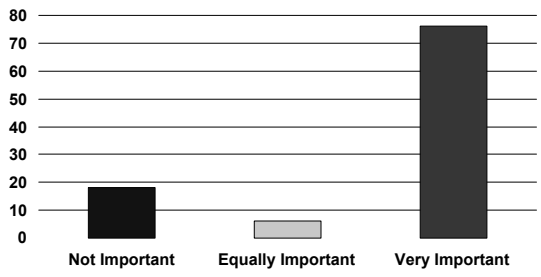
Are We Communicating? Ascribing Patient Motivation for Consults



Physician Interviews

- Family physicians interviewed in their offices
- Semi-structured interview modeled on the critical incident technique
- 15-minute interviews recorded and transcribed

Relative Importance of Antibiotic Prescribing Issues



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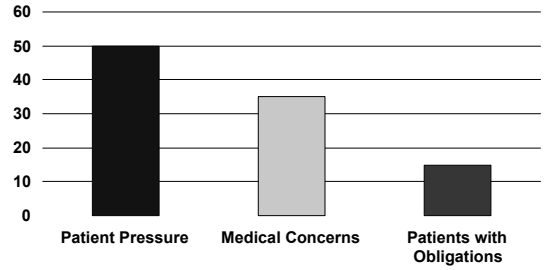
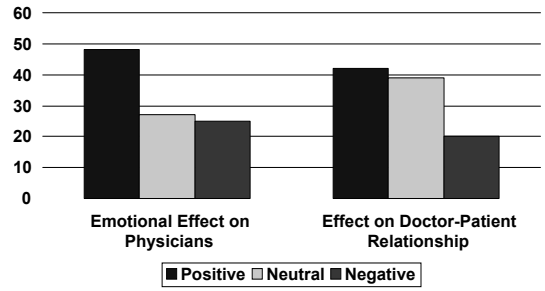
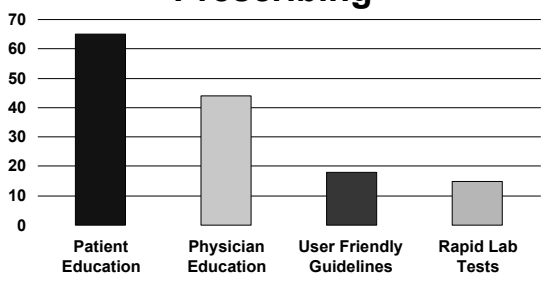
Factors in Prescribing Decisions When Antibiotics Were Probably Not Needed



Emotional Impacts of Physician Not Giving into Patient Pressure



Physician Suggested Methods to Improve Antibiotic Prescribing



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Conclusions Drawn From Physician Interviews

- A very important issue for physicians
- Patient pressure perceived as a major factor in inappropriate antibiotic use
- Appropriate prescribing has positive or neutral emotional effects for physicians and doctor-patient relations
- Patient and physician education seen as means to improve practices

Antibiotic Improvement in Community Settings

Antibiotics in Moderation Community Intervention

- 1,744 doctor visits included in prefeedback analyses
- 1,192 included in post feedback analyses
- 46 family physicians in SE Ontario recorded consecutive patient encounters, indicating drugs recommended and or prescribed, diagnosis, patient age and sex, co-morbidity and whether repeat visit and sample provided

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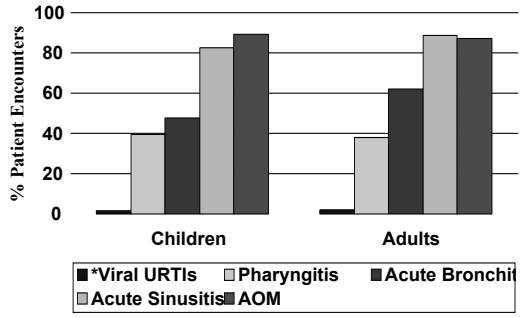
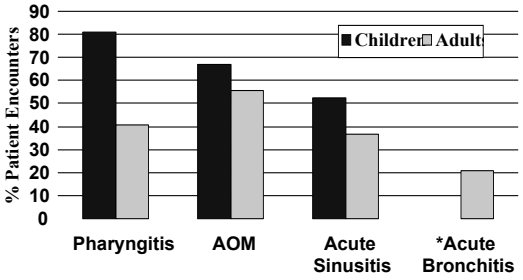
Antibiotic Prescribing Rates

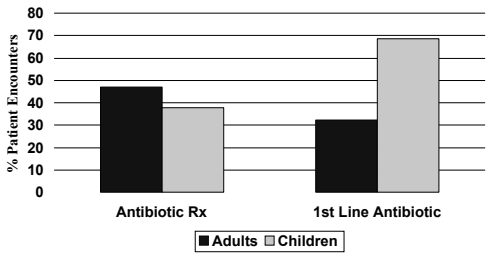


First Line Prescribing Rates



*Antibiotic are not recommended for Acute Bronchitis in children

Patient Age and Antibiotic Decisions



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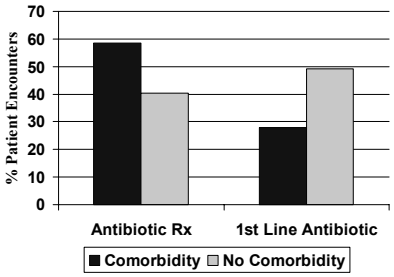
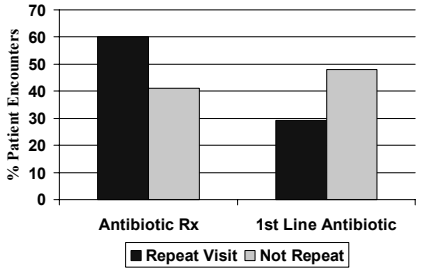
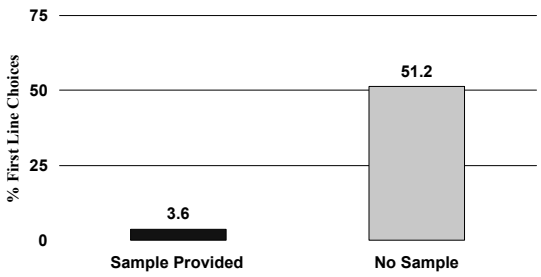
Co-morbidity and Antibiotic Decisions



Second Consult for Same Illness and Antibiotic Decisions



Samples and First Line Antibiotics



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AIM Prefeedback Conclusions

- Antibiotics were often prescribed inappropriately with respect to indication and drug choice.
- Patient age, co-morbidity, repeat visits, and provision of samples influenced antibiotic prescribing practices for URTI diagnoses.
- Patients recommended OTCs were less likely to receive antibiotic Rxs

AIM Feedback Intervention Purpose

- To test whether individual and peer-based feedback regarding antibiotic indication and drug choice demonstrated efficacy as means to improve antibiotic prescribing for URTIs by Canadian family physicians

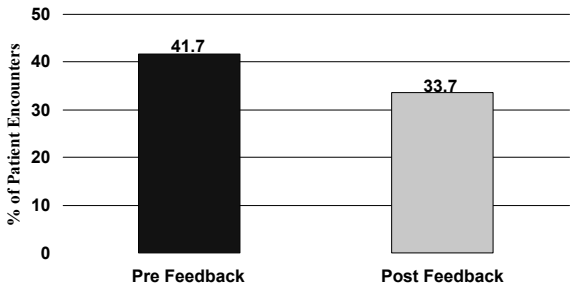
Feedback Report

- After a 2 month baseline physicians were provided with report of their own and peer antibiotic prescribing evaluated according to the Ontario Anti-infective guidelines which were disseminated Ontario-wide in 1994, 1997 and 2005
- Emphasis given to the identified problem areas of prescribing rates for acute bronchitis and pharyngitis and first line and extended spectrum macrolide use

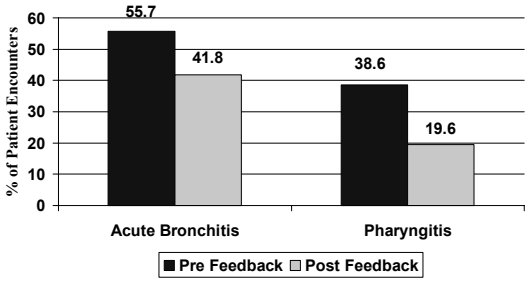
Post Feedback

- There were no significant differences found pre and post feedback for:
  - Non-antibiotic Rxs and OTC recommendations
  - Age & sex of patient and co-morbidity
  - Whether sample provided or repeat visit
  - Diagnostic category distribution
- The only pre and post feedback differences were in the realm of antibiotic prescribing

Prescribing Rates for URTIs



Prescribing Rates for Acute Bronchitis and Pharyngitis



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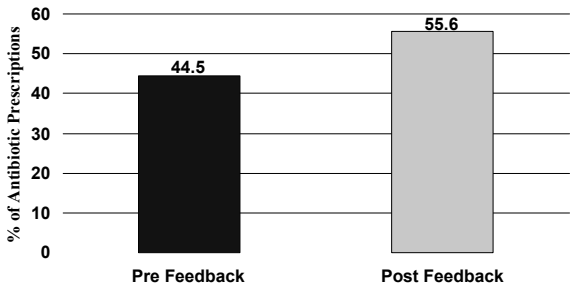
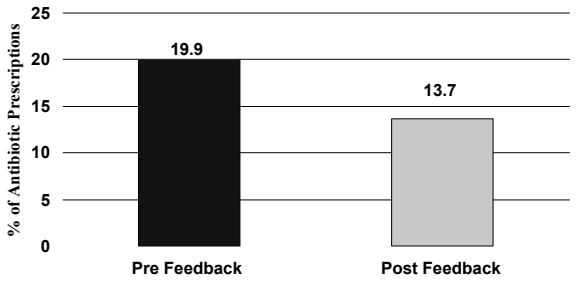
Use of First Line Antibiotics



Use of Extended Spectrum Macrolides



AIM Post Feedback Conclusions

- A single instance of feedback significantly improved antibiotic prescribing practices for URTIs :
  - Decreased antibiotic use
  - Greater use of first line antibiotic choices

Costs Associated with Increased Bacterial Resistance

- ↑Treatment failures
- ↑Morbidity and mortality
- ↑Risk of hospitalization
- ↑Length of hospital stays
- ↑Need for expensive and broad spectrum antibiotics

IMPACTS OF A COMPUTER ORDER-ENTRY SYSTEM ON ANTIBIOTIC USE IN A COMPLEX CONTINUING CARE AND REHABILITATION FACILITY

Fung J †, Zoutman D†‡ , Campbell D ‡, Ford D †, Nakatsu K †
† Queen's University ‡ St. Mary's of the Lake Hospital, Kingston, Ontario

St. Mary's of the Lake Hospital

- St. Mary's of the Lake Hospital (SMOL) is a 150 bed referral institution specializing in geriatrics, continuing care, rehabilitation medicine, and palliative care.

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Objective

- To examine the impacts of a computer drug order-entry system on antibiotic use at SMOL

Introduction

- Antibiotics are frequently over prescribed in long-term care facilities
- Between 50 and 75% of residents receive at least one treatment course of antibiotics per year
- Antibiotics are often inappropriately prescribed for asymptomatic bacteriuria or minor respiratory infections

Methods

- Comparative before and after analysis of antibiotic prescription rates for 1998 and 1999 following implementation of computer-order entry system in 1999
- The measure used for comparisons was Antibiotic Utilization Ratio (AUR): number of antibiotic days / number of patient care days
- Computer entry allows for in depth analysis of antibiotic prescribing practices in 1999

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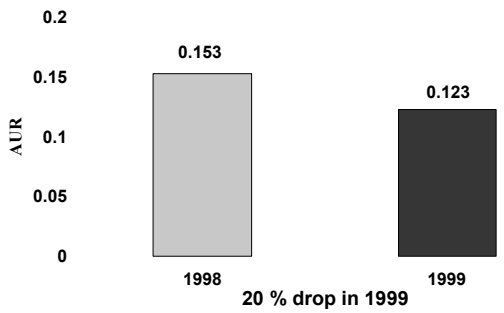
Computer-Order Entry System

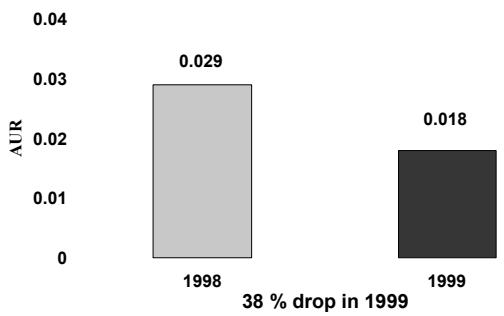
- *Meditech* system
- Restricted choice of drugs
- Input of dosage and duration of therapy required
- Input of indication and type of therapy: directive, empiric, and prophylactic

Total Antibiotic Use



20 % drop in 1999

Ciprofloxacin Use



38 % drop in 1999

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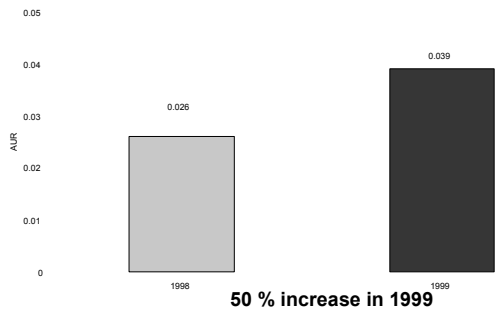
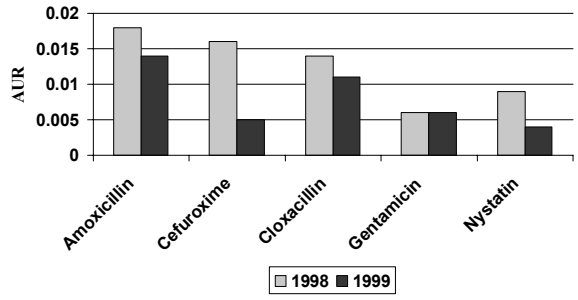
TMP/SMX Use



50 % increase in 1999

Types of Antibiotics Prescribed



Conclusions

- The preliminary results indicated the computer order-entry system increased the appropriateness of antibiotic prescribing in SMOL
  - –Total antibiotic use decreased by 20%
  - –Antibiotic choices improved dramatically

Economic Implications

- Decreased costs associated with overall decreased use of antibiotics
- Savings from proportionally greater use of less expensive antibiotics such as TMP/SMX
- Decreased costs resulting from fewer adverse effects and antibiotic-drug interactions

Peri-Operative Antibiotics in Acute Care Surgery

The Study Setting

- Kingston General Hospital
- 466 tertiary care center
- Hospital based prospective cohort study
- Data collected between 1994 and 2000 (6 years)
- 7,388 patients entered into study
- 669 cases excluded

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Surgical Wound Surveillance Methods

- **Full Time Infection Control Practitioner**
- **Receives OR list each day**
- **Reviews chart and examines wound every 48-72 hours or more often if suspicious of infection**
- **CDC's definition of wound infection used**
- **Details of prophylaxis and selected risk factors recorded**
- **Review of patient care computer system for readmits with infection**
- **Monthly reports to each surgeon/ICC**

Inclusion/Exclusion Criteria

Included

- CABG
- Cardiac Valves
- Lung Resection
- AAA
- Lower Limb Vascular
- Colonic Resection
- Abdo-Hysterectomy
- Hip/Knee Replacement

Excluded

- Emergency procedures
- Wound class of 3 or 4
- Patients <18 years
- Patient with 2 or more procedures requiring >1 incisions during the same operation
- Patient on antibiotics 24 hour pre-op for infections or endocarditis prophylaxis
- Incomplete data in chart

Outcome Variables

- **Effective First Prophylactic Dose (EFPD):**
  - **Correct Drug (guidelines)**
  - **Correct Dose (guidelines)**
  - **Correct Route**
  - **Correct Timing (within 120 minutes pre-op)**
- **Surgical Wound Infection**
  - **CDC criteria**

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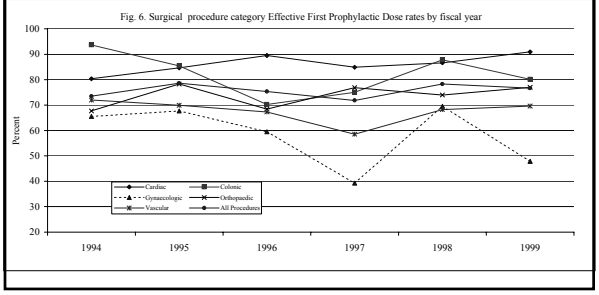
Surgical Prophylactic Antibiotic Protocol

Procedure	1st Choice	Alternative
Coronary artery bypass grafting or valve replacement	cefazolin	vancomycin
Vascular surgery of abdominal aorta, groin vessels, or insertion of a prosthetic graft	cefazolin	vancomycin
Total joint replacement	cefazolin	vancomycin
Colorectal surgery	neomycin + erythromycin orally and/or metronidazole + gentamicin	neomycin + erythromycin orally and/or cefotetan
Thoracotomy for lung resection	cefazolin	vancomycin
Hysterectomy, abdominal	cefazolin	Doxycycline IV one dose or metronidazole + gentamicin

Analyses

- Univariate analysis:
  - Produce frequencies and rates
  - Assess distributions, normality, skewness
- Bivariate analysis:
  - Evaluation of associations (2 x 2 tables)
  - Unadjusted odds ratios
  - Stratified frequencies and rates
- Multivariate analysis:
  - Enter statistically significant variables into multiple logistic regression model
    - EFPD, SSI as outcomes

Effective First Prophylactic Dose Success Rate over 6 Years



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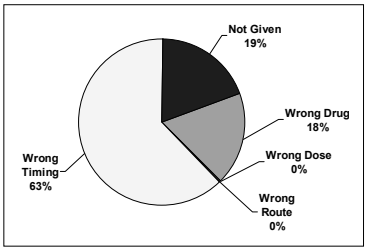
EFPD Component Errors



Note: 86 % of "Not Given" were from gynaecology

Summary of Factors Predicting for EFPD

Procedure	Order Written	SPA Given in OR	ß lactam allergy	Same Day Admit
Cardiothoracic	–	+	–	–
Vascular	+	+	–	–
Colonic	+	+	–	–
Hysterectomy	+	–	–	–
Joint Replacement	+	+	–	+

Interventions

- Improving Awareness
  - Feedback EFPD rates to surgeons, OR Staff
- Analysis of workflow
  - Preop assessment of "allergies"
  - Start IV's in one location preoperatively
  - OR stock of approved antibiotics
- Responsibility to write the order for SPA
  - Anesthesiology vs surgery

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Suggested Readings

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The Next Few Teleclasses

May 25	***Infection Control in the Cruise Ship Industry*** … with Dr. Robert Wheeler
June 1	***Infection Control in Healthcare Construction*** ... with Dr. Andrew Steifel
June 8	***Zoonosis from Companion Animals & Pets*** … with Dr. Corrie Brown
June 22	***Controlling Pediatric Respiratory Infections*** … with Marion Yetman, Laurie Streitenberger, Anne Augustin

For the full teleclass schedule – www.webbertraining.com

Hosted by Paul Webber paul@webbertraining.com
www.webbertraining.com