

## **Antimicrobial Resistance Panel:**

# **Promoting Appropriate Antimicrobial Drug Use in Developing Countries**

**Sayomporn Sirinavin, M.D.**

**Division of Infectious Disease and Epidemiology**

**Department of Pediatrics**

**Faculty of Medicine Ramathibodi Hospital**

**Mahidol University, Bangkok, Thailand**

**rassr@mahidol.ac.th**

CHINA'S CRACKDOWN ON CORRUPTION

# Newsweek

THE INTERNATIONAL

March 25, 2008

# ANTIBIOTICS

## THE END OF MIRACLE DRUGS?

**WARNING**

**NO LONGER  
EFFECTIVE  
AGAINST  
KILLER  
BUGS**



ISSN 0028-2811  
Volume 144 Number 12  
March 25, 2008

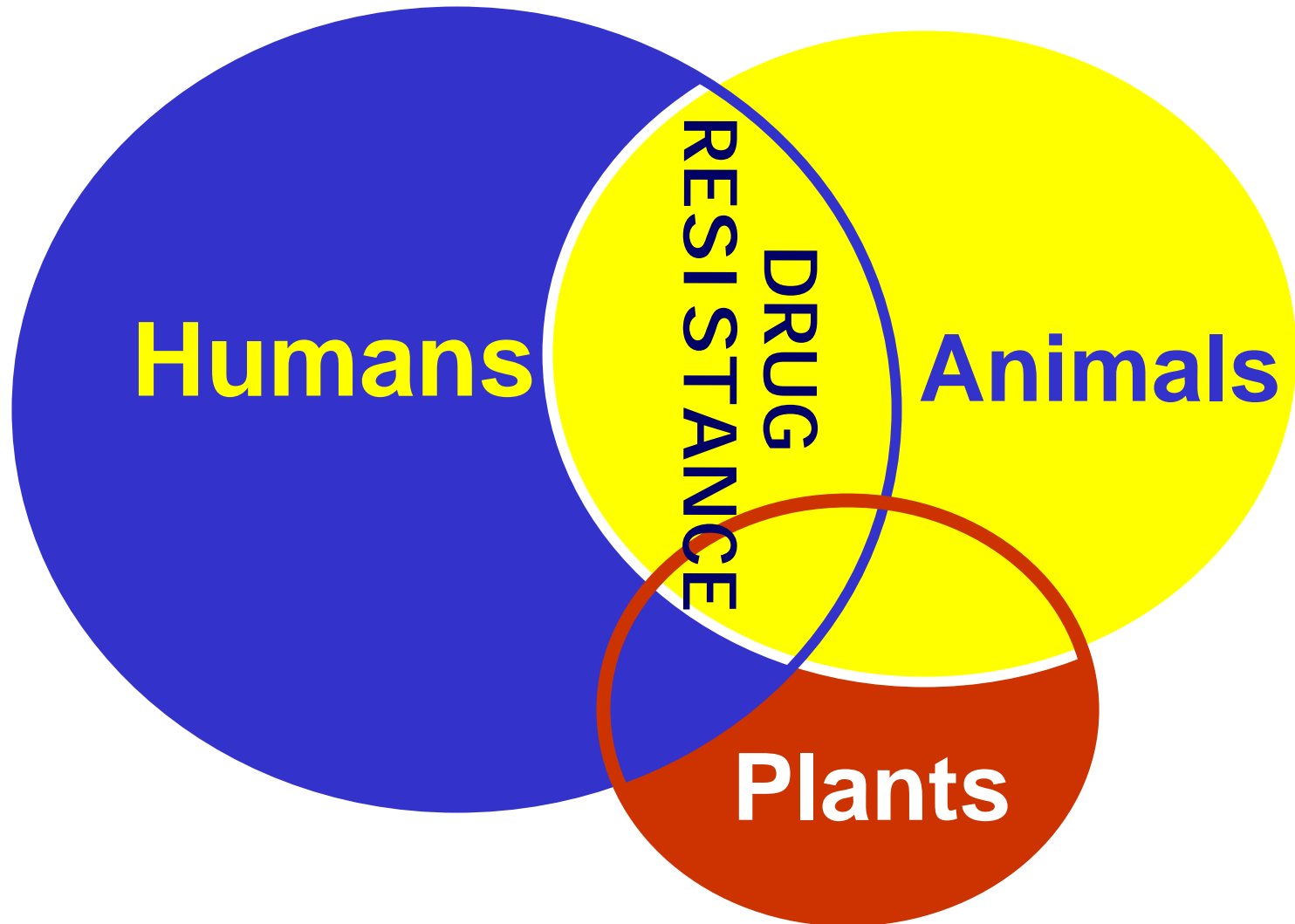
Subscription Rates  
Single Copy \$4.99  
6 Months \$24.99  
1 Year \$44.99

Advertising Rates  
Printed in the USA  
Copyright © 2008 Time Warner  
All rights reserved.

Parent Company  
Time Warner Entertainment  
Company L.P.  
New York, NY 10036

Parent Company  
Time Warner Entertainment  
Company L.P.  
New York, NY 10036

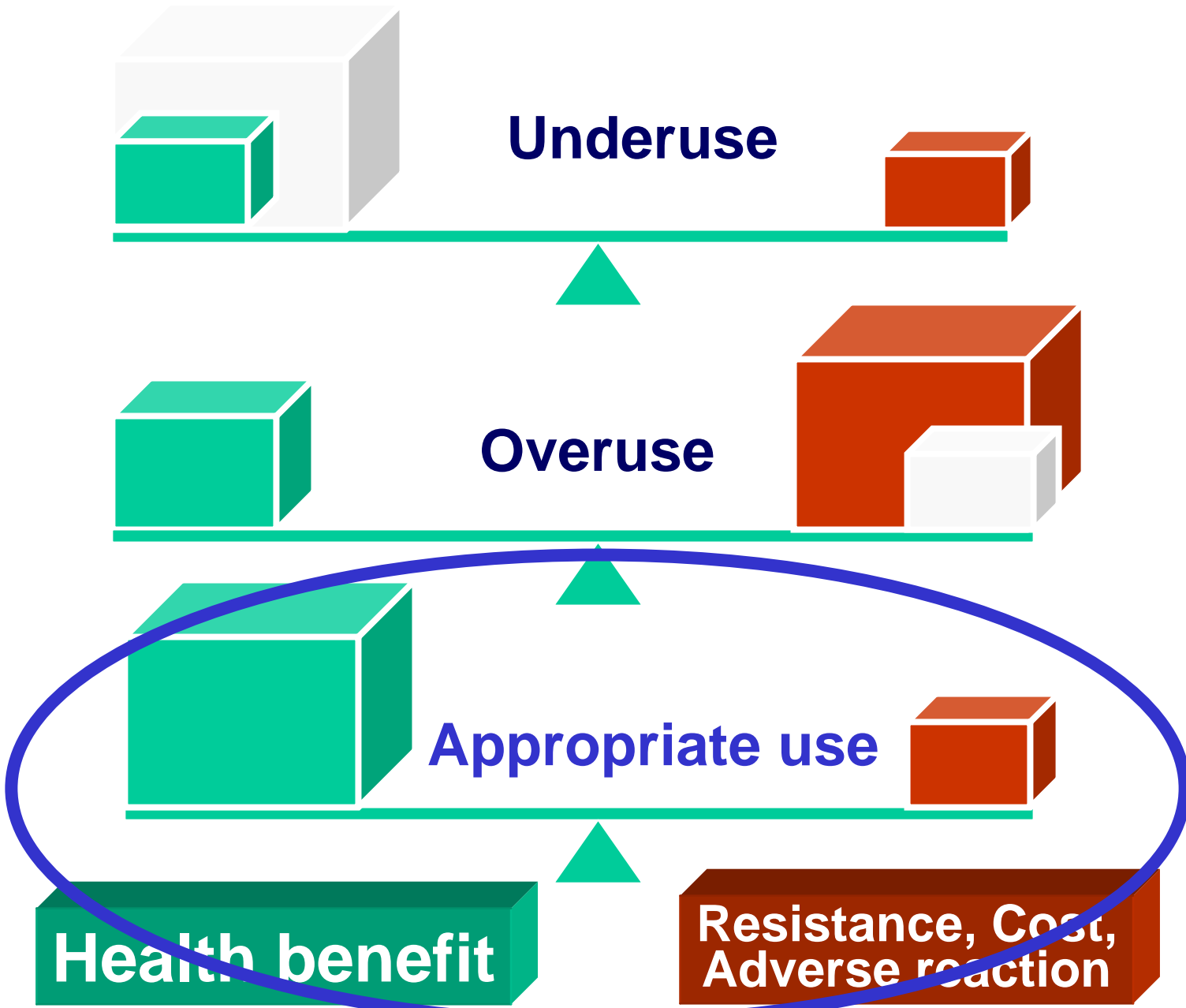
# Where Antimicrobials are Used



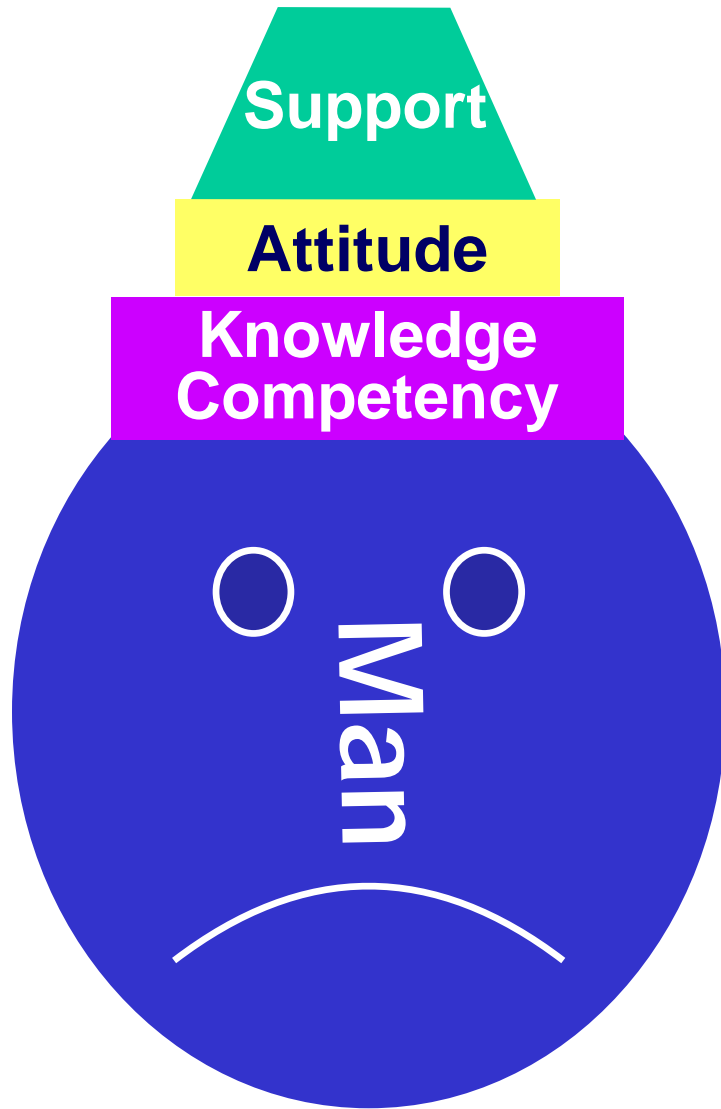
# Appropriateness of antimicrobial drug use

**Maximizing health benefit**

**Minimizing development of resistance, ADR, and cost.**



# Why inappropriate ?



Poorly distributed

Too many

Substandard

**Drugs**

Too few

Normal flora  
(Friends)

Human

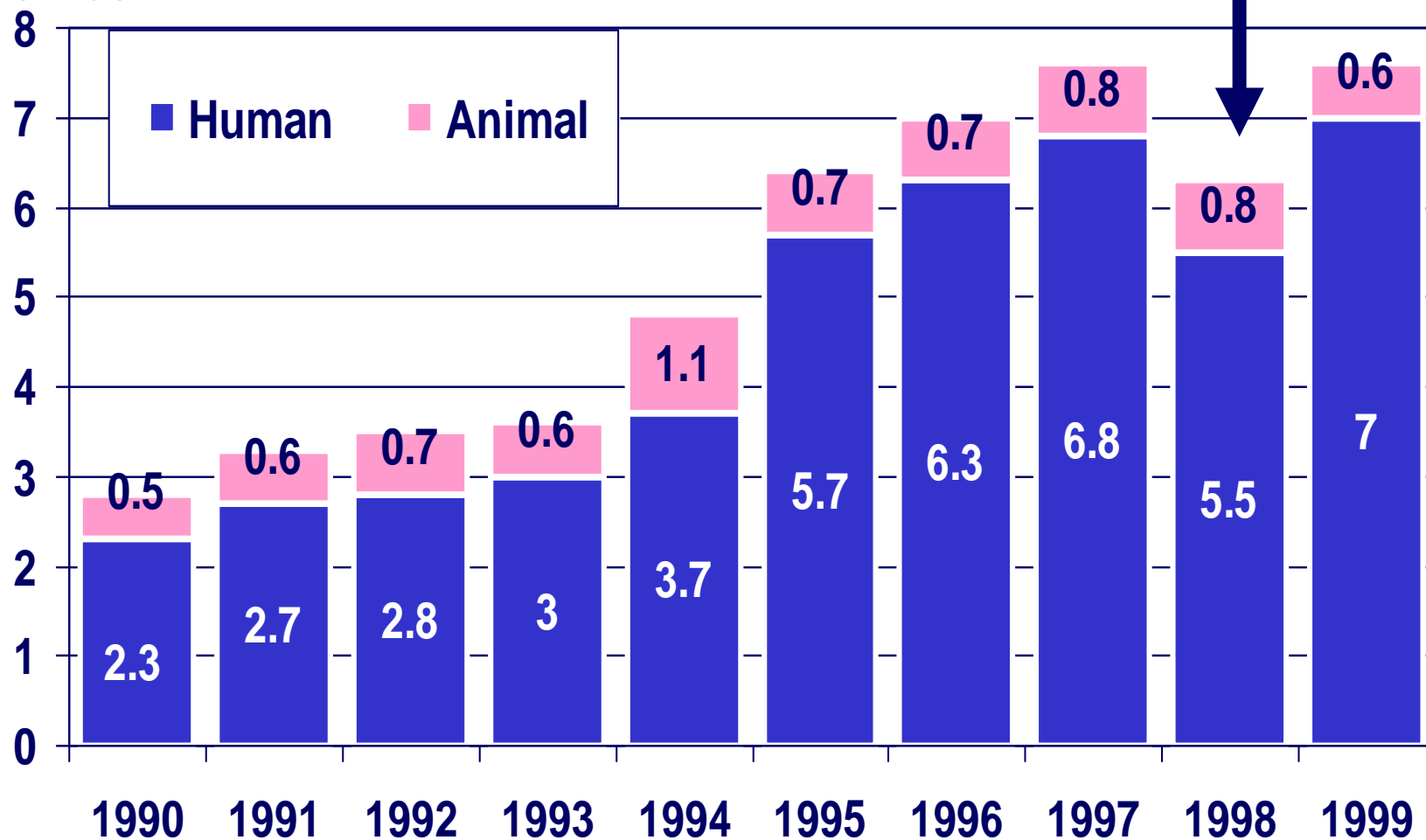
**Microbes**

Animals

Pathogens  
(Enemies)

# Annual Expense on Antimicrobial Agents Thailand, 1990-1999

x 10<sup>3</sup> million  
Thai baht



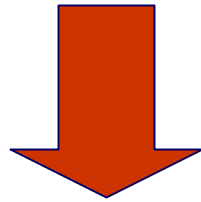
Source: FDA, Thailand

# Licensed Antimicrobial Drugs in Thailand, 1998

## Antibacterial Drugs

Amikacin	Cefprozil	Fosfomicin	Ornidazole	Sulfamethizole
Amoxicillin	Cefsulodine	Framycetin	Oxacillin	Sulfamethoxy- pyridazine
Ampicillin	Ceftazidime	Furazolidone	Oxytetracycline	Sulfasalazine
Azithromycin	Ceftibuten	Fusidic acid	Pefloxacin	Sulfasomidine
Azusulfamide	Cefizoxime	Gentamicin	Penicillin G	Sulfathiazole
Aztreonam	Ceftriaxone	Imipenem	Penicillin V	Sultamicillin
Bacampicillin	Cefuroxime	Kanamycin	Phthalyl sulfathiazole	Tetracycline
Carbenicillin	Cefpodoxime	Lincomycin	Pipemidic acid	Thiamphenicol
Cefaclor	Chloramphenicol	Lemefloxacin	Piperacillin	Teicoplanin
Cefadroxil	Chlortetracycline	Mecillinam	Pivampicillin	Tinidazole
Cefalexin	Ciprofloxacin	Methenamine	Pivmecillinam	Tobramycin
Cefamandol	Clarithromycin	Methicillin	Spiramycin	Trimethoprim
Cefazolin	Clindamycin	Metronidazole	Sulfacetamide	Vancomycin
Cefdinir	Clioquinol	Midecamycin	Sulfamethoxazole	Amoxicillin + Clavulanic a
Cefixime	Cloxacillin	Minocycline	Rolitetracycline	Ampicillin + Sulbactam
Cefminox	Colistin	Mupirocin	Roxithromycin	Ticarcillin + Clavulanic a
Cefodixime	Co-trimoxazole	Nalidixic Acid	Silver Sulfadiazine	Cefoperazone + Sulbactam
Cefoperazone	Dibekacin	Neomycin	Spectinomycin	
Cefotaxime	Dicloxacillin	Netilmicin	Streptomycin	
Cefotiam	Doxycycline	Nitrofuraxazide	Sulbenicillin	
Cefoxitin	Erythromycin	Nitrofurantoin	Sulfadiazine	
Cefpirome	Fleroxacin	Norfloxacin	Sulfadimidine	
Cepodoxime	Flucloxacillin	Ofloxacin		

**To many items**



**National Drug List**



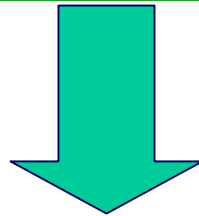
**National Drug List, Thailand, 1999**  
**Antimicrobial selection by**  
**using a scoring system**

**National Committee on National Drug List**

**Sub-committee on antimicrobial drugs**

## **Opinion-based drug selection :**

- Different individual opinions**
- Influence of drug company, and influential members**
- Biased selection**
- Not clearly expressed**



**Evidence-based  
antimicrobial drug selection**

# **National Drug List, Thailand, 1999**

## **Antimicrobial selection by using a scoring system**

**National Committee on National Drug List**

**Sub-committee on antimicrobials**

**Explicit guideline for drug selection**

**Develop a “scoring system”**

# Explicit guideline for selection of antimicrobial drugs

1. List of all available antimicrobial drugs licensed in Thailand, provided by FDA
2. Exclude the well-known inappropriate drugs e.g. dibekacin, ampicillin+cloxacillin
3. Group the competitive drugs according to their clinical and microbiological indications e.g. cloxacillin and oxacillin
4. Compare the competitive drugs using a scoring system
5. Rational judgement
6. Record the reason for choosing or not choosing a drug

# **“Scoring system”**

**for selection of antimicrobial drugs,  
National Drug List, Thailand 1999**

- Route**
- Efficacy**
- Safety**
- Cost**
- Ease of administration**
- Bioavailability**
- Tolerability**
- Availability**
- Total score**
- Decision**
- Comment**

	Ro	eff	sf	inf	ESI	mg	original	local	G/day	B/day	fre	food	toler	Comp	O/L	difOL	Distri	Avail	Factor	Score	Decis	class	
Beta-lactams																							
Penicillin G, benzyl	I						6.84	6.84	0.75						1	0.8						+	1
Penicillin G, benzathine	I					1.2 mu	40.8	34.95	0.75						1.167	0.8						+	1
Penicillin G, procaine	I					4 mu	20	20	0.5						1	0.8						+	1
Penicillin V	O					250	0.72	0.72	2						1	0.8						+	1
Cloxacillin	I	1	1	1	1	1000	22	17.04	6	132	0.7	1	1	0.7	1.291	0.8	1	0.8	0.56	236	+	1	
Oxacillin	I	1	1	1	1	1000			6		0.7	1	1	0.7		xx							
Flucloxacillin	I	1	1	0.9	0.9	1000			6		0.7	1	1	0.7		xx							
Lincomycin	I	0.9	1	1	0.9	600	64.23	18.12	1.8	192.69	0.8	1	1	1	3.545	0.9	1	0.9	0.81	238	+	1	
Clindamycin	I	1	0.9	1	0.9	600	379.17	379.17	1.2	758.34	0.8	1	1	1	1	0.8	1	0.8	0.72	1053	+	2	
Cloxacillin*	O	1	1	1	1	250	2.37	1.57	2	18.96	0.7	0.9	1	0.63	1.51	0.8	1	0.8	0.50	38	+	1	
Oxacillin	O	1	1	1	1	250	4	3	2	32	0.7	0.9	1	0.63	1.333	0.8	0.9	0.72	0.45	71	-		
Dicloxacillin*	O	1	1	1	1	250	4.13	2.45	1	16.52	0.7	0.9	1	0.63	1.686	0.9	1	0.9	0.57	29	+	1	
Flucloxacillin	O	1	1	0.9	0.9	250	5.5	5.5	1	22	0.7	0.9	1	0.63	1	0.8	0.9	0.72	0.41	54	-		
Ampicillin	I	1	1	1	1	250	6.67	6.67	4	106.72	0.7	1	0.9	0.63	1	0.8	1	0.8	0.50	212	+	1	
Ampicillin	O	1	1	1	1	500			2		0.7	0.9	0.9	0.567		xx	1						
Bacampicillin	O	1	1	0.9	0.9	400			0.8		0.9	1	1	0.9		xx							
Metampicillin	O	1	1						2					0		xx							
Pivampicillin	O	1	1	0.9	0.9				2					0		xx							
Amoxycillin	O	1	1	1	1	500	4.81	2.29	0.75	7.215	0.8	1	1	0.8	2.1	0.9	1	0.9	0.72	10	+	1	
Cefazolin	I	1	1	1	1	1000	47.75	23.08	3	143.25	0.8	1	1	0.8	2.069	0.9	1	0.9	0.72	199	+	1	
Cephalexin	I	1	1	0.7	0.7	1000	74	74	4	296	0.8	1	1	0.8	1	0.8	0.9	0.72	0.40	734	-	-	
Clindamycin	I	1	0.9	1	0.9	600	379.17	379.17	1.2	758.34	0.8	1	1	1	1	0.8	1	0.8	0.72	1053	+	2	
Clindamycin	O	1	0.9	0.9	0.81	150	11.72	11.72	1.2	93.76	0.7	0.9	0.9	0.567	1	0.8	1	0.8	0.37	255	+	2	
Cephalexin	O	1	1	1	1	500	10.52	5.64	2	42.08	0.7	0.9	1	0.63	1.865	0.9	1	0.9	0.57	74	+	1	
Cefadroxil	O	1	1	1	1	500	23	23	1.5	69	0.9	0.9	1	0.81	1	0.8	0.9	0.72	0.58	118	-	-	
Cefoxitin	I	0.9	1	1	0.9	1000	213.8	147	3	641.4	0.8	1	1	0.8	1.454	0.8	1	0.8	0.58	1114	+	3	
Cefmetazole	I															xx							
Co-amoxiclav	I	0.9	1	0.9	0.81	1200	225.28	225.28	3.6	675.84	0.8	1	1	0.8	1	0.8	0.9	0.72	0.47	1449	+	3	
Sultamicillin	I	1	1	0.9	0.9	1500	193.33	193.33	4.5	579.99	0.8	1	1	0.8	1	0.8	0.9	0.72	0.52	1119	+	3	
Cefuroxime	I	1	1	1	1	750	187.06	109.2	2.2	548.7093	0.8	1	1	0.8	1.713	0.9	1	0.9	0.72	762	?	?	
Cefamandole	I	1	1	1	1	1000	212.85	186	4	851.4	0.7	1	1	0.7	1.144	0.8	1	0.8	0.56	1520	—		
Cefotiam	I	1	1	0.7	0.7	1000	324	324	4	1296	0.7	1	1	0.7	1	0.8	0.9	0.72	0.35	3673	—		
Cefaclor	O	0.9	1	1	0.9	250	19.09	19.09	0.75	57.27	0.8	0.9	1	0.72	1	0.8	1	0.8	0.52	110	?	2	
Cefprozil	O	1	1	0.9	0.9	250	31.25	31.25	0.5	62.5	0.9	0.9	1	0.81	1	0.8	0.9	0.72	0.52	119	+	2	
Cefuroxime axetil	O	1	1	1	1	250	27.43	27.43	0.5	54.86	0.9	0.9	1	0.81	1	0.8	0.9	0.72	0.58	94	+	2	
Co-amoxiclav	O	1	1	1	1	375	22.32	11.79	1.125	66.96	0.8	1	0.9	0.72	1.893	0.9	1	0.9	0.65	103	+	2	
Sultamicillin	O	1	1	0.9	0.9	375	23.83	23.83	1.125	71.49	0.8	1	0.9	0.72	1	0.8	0.9	0.72	0.47	153	—		
Cefotaxime*	I	1	1	1	1	1000	192.93	85.12	4	771.72	0.9	1	0.9	0.81	2.267	0.9	1	0.9	0.73	1059	+	3	
Ceftriaxone*	I	1	1	1	1	1000	431.63	132.42	2	863.26	1	1	0.9	0.9	3.26	0.9	1	0.9	0.81	1066	+	3	
Ceftizoxime	I	1	1	0.8	0.8	1000	220	220	3	660	0.8	1	0.9	0.72	1	0.8	0.9	0.72	0.41	1591	-		
Cefodizime	I	1	1	0.8	0.8	1000	434	434	2	868	0.9	1	0.9	0.81	1	0.8	0.9	0.72	0.47	1860	-		
Cefixime*	O	1	1	0.9	0.9	100	36	36	0.4	144	0.9	1	0.9	0.81	1	0.8	0.9	0.72	0.52	274	+	3	
Cefpodoxime*	O	1	1	0.9	0.9	100	28.79	28.79	0.4	115.16	0.9	0.9	0.9	0.729	1	0.8	0.9	0.72	0.47	244	+	3	
Ceftibuten*	O	1	1	0.9	0.9	400	138.73	138.73	0.4	138.73	1	1	0.9	0.9	1	0.8	0.9	0.72	0.58	238	+	3	
Cefdinir*	O	1	1	0.9	0.9	100	28.21	28.21	0.4	112.84	0.9	1	0.9	0.81	1	0.8	0.9	0.72	0.52	215	+	3	
Cefsulodin	I	0.9	1	0.9	0.81	1000	298	298	4	1294.98	0.7	1	1	0.7	1	0.8	0.9	0.72	0.41	3172	—		
Cefoperazone	I	1	1	1	1	1000	363	363	3	1089	0.9	1	1	0.9	1	0.8	0.9	0.72	0.65	1681	-		
Ceftazidime	I	1	1	1	1	1000	195.03	160	6	1170.18	0.8	1	1	0.8	1.219	0.8	1	0.8	0.64	1828	+	3	
Piperacillin	I	0.9	1	1	0.9	2000	215.83	215.83	12	1294.98	0.7	1	1	0.7	1	0.8	0.9	0.72	0.45	2855	—		
Sulfooperazone	I	1	1	0.9	0.9	1000	472.88	472.88	4	1891.52	0.9	1	1	0.9	1	0.8	0.9	0.72	0.58	3243	+	3	
Cefpirome	I	1	1	0.9	0.9	1000	461	461	4	1844	0.9	1	1	0.9	1	0.8	0.9	0.72	0.58	3162	+	3	
Cefepime	I	1	1	0.9	0.9	1000	457.5	457.5	4	1830	0.9	1	1	0.9	1	0.8	0.9	0.72	0.58	3137.86	+	3	
Ticarillin	I	0.9	1	1	0.9	3000			18-24		0.7	1	1	0.7		xx							

# National Drug List, Thailand, 1999

## Antimicrobial selection by using a scoring system

**National Committee on National Drug List**

**Sub-committee on antimicrobials**

**Explicit guideline for drug selection**

**Develop a “scoring system”**

**Discussion**

**Decision**

**Indication**

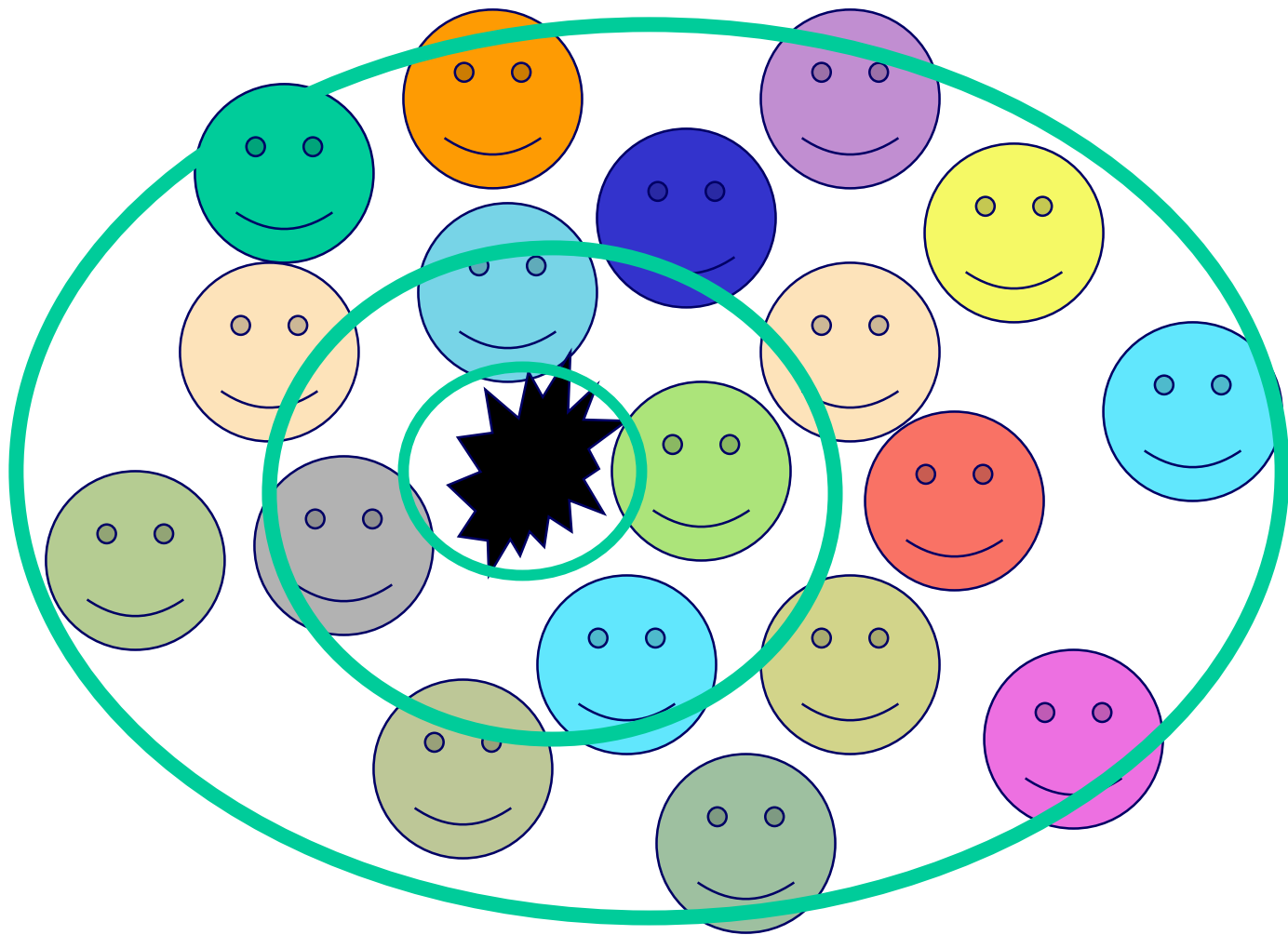
**Grouping by level of restriction**

# Restriction Policy for Antimicrobial Drugs

---

- 1. Commonly indicated drugs (Essential Drugs)**
  - all MDs should know how to use them well
  - e.g. penicillin G, V, cloxacillin, ampicillin, gentamicin, erythromycin, etc
- 2. Broad-spectrum but commonly indicated (due to local drug-resistance problems)**
  - e.g. cefotaxime, ceftriaxone, amikacin, etc.
- 3. Restricted drugs (DUE is required)**  
**(very broad-spectrum and expensive drugs)**
  - e.g. imipenem, meropenem, vancomycin, teicoplanin, ciprofloxacin, netilmicin, etc.





**If the enemy is not identified, how can we use a narrow-spectrum weapon to destroy them without doing harm to the other non-guilty ones.**

# Infectious Disease Diagnosis

---

- **Anatomic diagnosis**
- **Etiologic diagnosis**
- **Pathophysiologic diagnosis**

# Requirement for accurate diagnosis

---

- 1. Diagnostic competency**
- 2. Supportive information**
  - Epidemiology data**
  - Laboratory data**

# **Etiologic Epidemiology Data in developing countries**

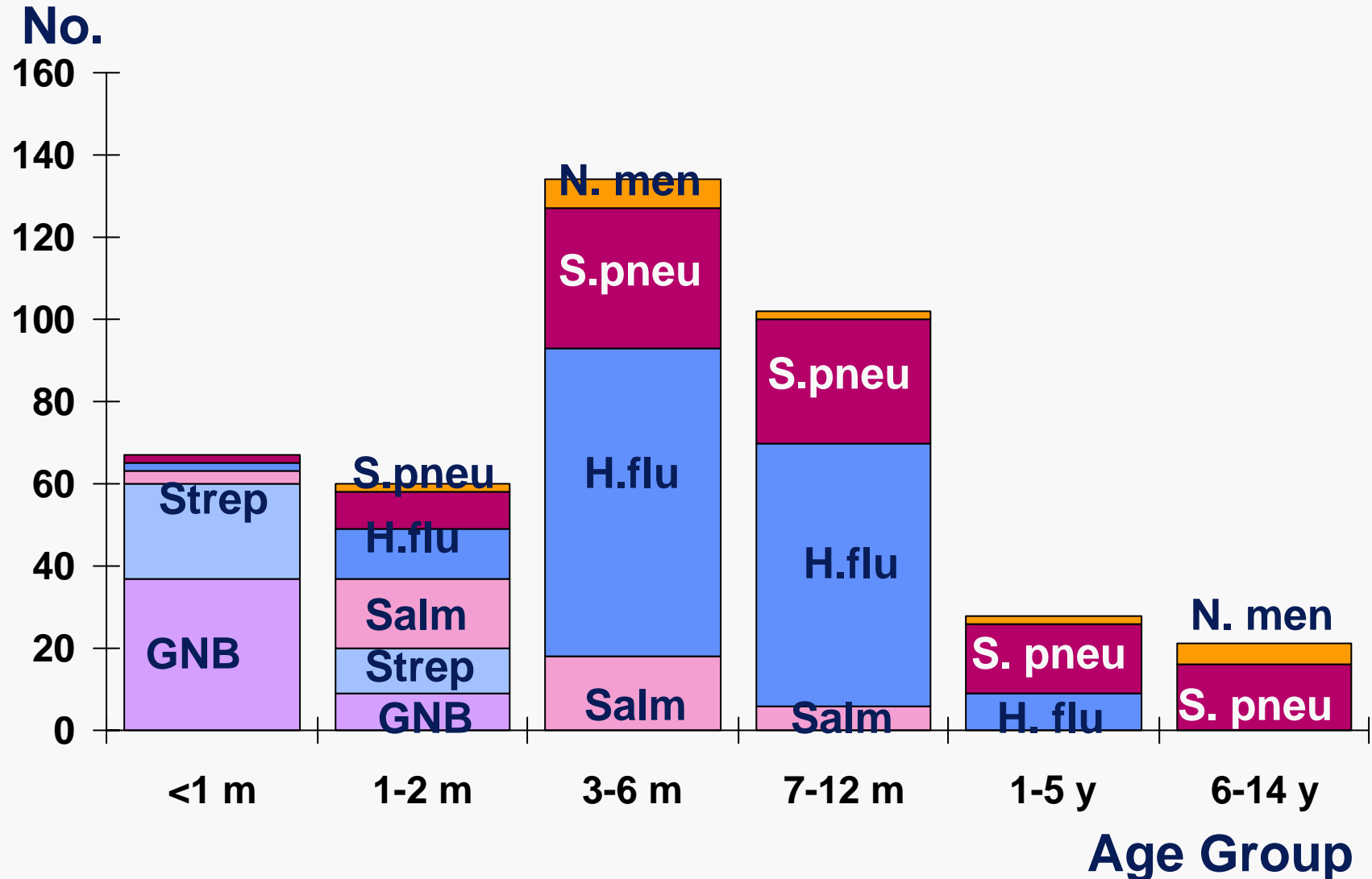
---

## **Usually**

- Deficient**
- Poorly gathered**
- Mostly tertiary-care hospital-based**
- Insufficient demographic and clinical data**
- Not integrated into practice**

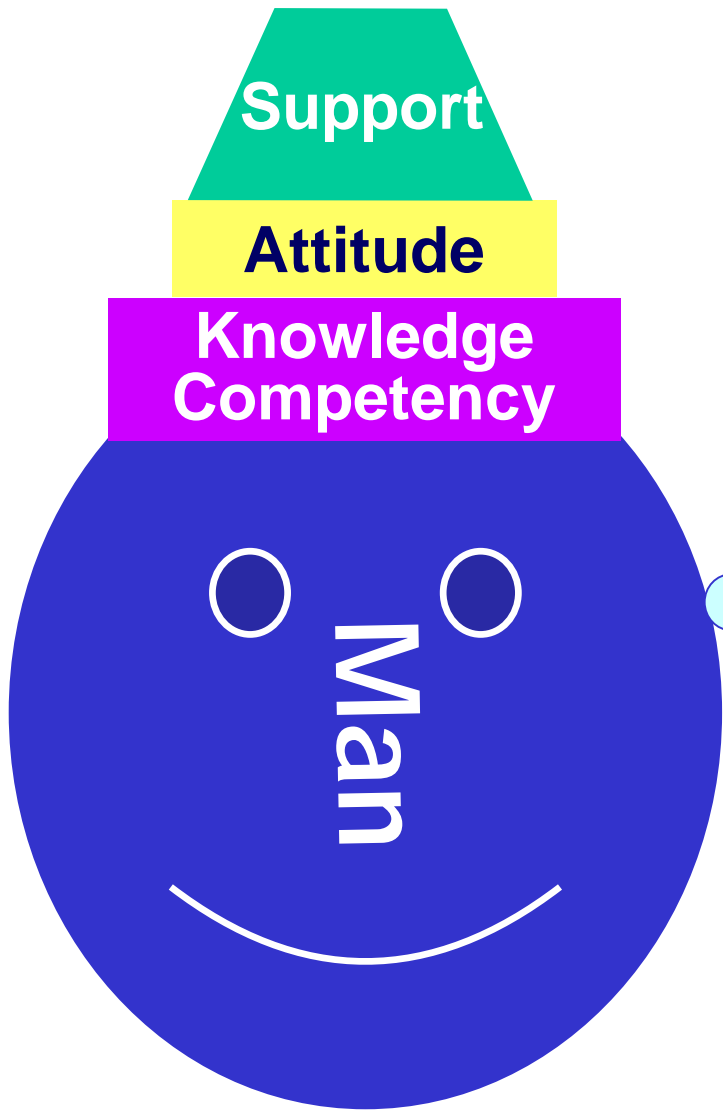
# Age-specific Etiology of Bacterial Meningitis in Thai Children

(National Study Group on Etiology of Bacterial Meningitis)



# **Microbiology Lab Facilities to support appropriate use of antimicrobials**

- 1. Appropriate clinical specimens**
- 2. Reliable isolation and identification**
- 3. Appropriate susceptibility test : drugs and discs**
- 4. Rapid reports**
- 5. Selective and educational report**
- 6. Appropriate interpretation and implementation**
- 7. Appropriate accumulative review**



He may have some kind of infection. This antibiotic may make him better and he will be satisfied. It is safe. He can afford it and I will get some money.

# Requirement for appropriate use of antimicrobial agents



**Diagnosis**

**Accurate diagnosis:**

- clinical diagnosis
- causative diagnosis



**Prescription**

**Cost-effective regimens**



**Dispensing**

**Good-quality drug**  
**Accurate dispensing**



**Administration**

**Good compliance**



# Requirement for cost-effective prescription

- 1. Competency of prescribers**
  - Infectious disease diagnosis
  - Clinical decision making
- 2. Accurate diagnosis**
- 3. Availability of good data for decision making**
- 4. Availability of drugs**
- 5. Patient & society - centered (NOT prescriber - centered)**

# Evidence-Based Clinical Decision Making: e.g. treatment of pneumonia with ampicillin

Probability  
of causative  
pathogens

SP	50%
HI	10%
Virus	40%

Resistance  
to ampicillin:

SP	20%
HI	30%

Expected %  
due to R bact.

SP	10%
HI	3%

Total %  
failure due  
to R bacteria  
13%

Outcomes of  
failure ?  
VS.  
Cost of the drug and  
selection of R bacteria

Minimise selection pressure, maximise treatment effectiveness.

# **Constraints in developing countries**

- Deficiency of epidemiology data and laboratory support for etiologic diagnosis**
- Deficiency of probability data input for decision making**

# **Getting evidence to support clinical decision**

**Antibiotics for treating  
salmonella gut infection**

**Sirinavin S, Garner P**

**Cochrane Database Systematic Review  
2000;2:CD001167**

# **Does antimicrobial therapy improve outcomes of salmonella gut infection?**

- 1. Duration of illnesses**
- 2. Duration of diarrhea**
- 3. Duration of fever**
- 4. Systemic complication**
- 5. Duration of salmonella excretion**
- 6. Emergence of resistance bacteria**
- 7. Adverse effects of therapy**

# Search Strategy

- Any comparative studies on antibiotic therapy for non-typhoidal salmonella
- From:
  - The Cochrane Controlled trials Registers
  - MEDLINE 1980-1997
  - ExtraMed
  - Reference lists of all potential trials

# Selection criteria

- All trials (RCT) comparing antibiotic therapy with placebo / no antibiotic

# Reviewed trials

- **15 clinical trials**
  - 14 published in 1972-1996
  - from Europe & Scandinavia 6,  
North America 4  
Australia 1, Colombia 1, Egypt 1  
International multicentered 2
  - on 857 participants  
( 43% were infants and children)
- **7.2% were asymptomatic**  
**92.8 % had diarrhea**



# Outcomes

## Any antibiotics VS. placebo / no antibiotic

<u>Clinical outcome</u>	<u>Pooled WMD</u>	<u>95% CI</u>
Duration of illness (days)	- 0.07	- 0.55, 0.40
Duration of diarrhea (days)	- 0.03	- 0.53, 0.48
Duration of fever (days)	- 0.45	- 0.98, 0.08

Adverse drug reaction OR 1.67 (95%CI 1.05, 2.67)

### Bacteriologic outcome

more in antibiotic group

- Bacteriologic relapse
- *Salmonella* in stool after 3 weeks

# **Efficacy of norfloxacin or azithromycin in treating non-typhoidal *Salmonella* carriers**

---

**Setting : a province in Thailand**

**Study population : asymptomatic food handlers**

**Method : double-blinded RCT**

**Study regimens :**

- 1. Norfloxacin 400 mg PO bid x 5 days**
- 2. Azithromycin 500 mg PO bid x 5 days**
- 3. Placebo PO bid x 5 days**

**(Department of Communicable Dis, MOPH, Thailand, 2001)**

**Total screening numbers : 3205**  
**Positive culture : 317 (10%)**  
**Inclusion to study : 284**

<b>RSC</b>	<b>% positive salmonella</b>			
	<b>D7</b>	<b>D30</b>	<b>D60</b>	<b>D90</b>
<b>Same serotypes</b>				
<b>Norflox</b>	<b>1.1</b>	<b>2.3</b>	<b>2.4</b>	<b>1.4</b>
<b>Azithro</b>	<b>0</b>	<b>1.1</b>	<b>0</b>	<b>3.8</b>
<b>Placebo</b>	<b>1.1</b>	<b>2.4</b>	<b>3.6</b>	<b>3.7</b>

**(Preliminary data)**

## **Recommendation:**

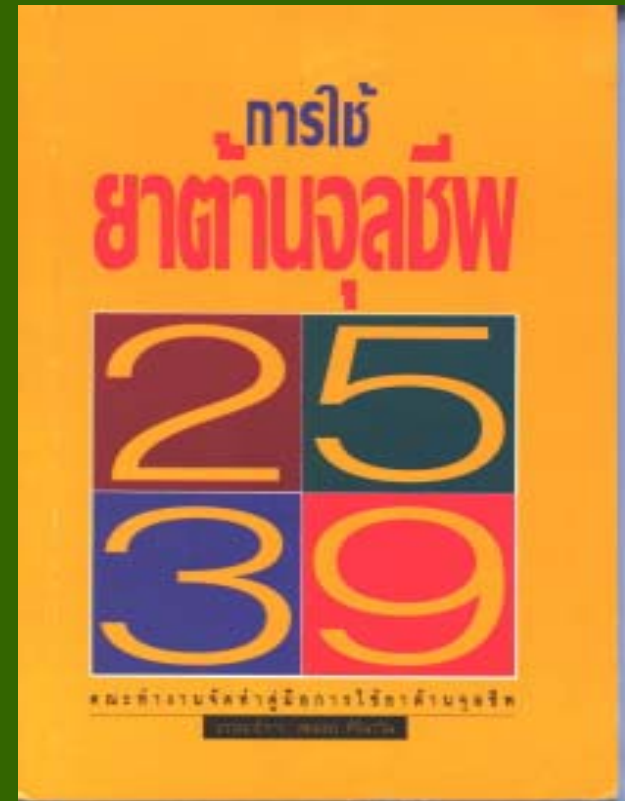
- No antimicrobial drugs for uncomplicated non-typhoidal *Salmonella* gut infection in normal hosts.**
- Antimicrobial drugs must be given to patients suspected or proved of extra-intestinal *Salmonella* infection.**

**น**ารบริหารจัดการ  
เพื่อพัฒนาการใช้  
ยาต้านจุลชีพในโรงพยาบาล

สำนักควบคุมการรังโรคและการแพทย์  
สำนักการปลีตการกระทรวงสาธารณสุข  
International Network for Rational Use of Drugs (Thailand)

บรรณาธิการ  
สมพร สิริภวีน, ศวีเพ็ญ สันติเวส, ศิวพร จิตธรรม

**Guideline for  
hospital management to promote  
appropriate use of antimicrobial drugs  
1995 (supported by Thai FDA & INRUD)**



**Pocket book on  
antimicrobial therapy**

# **Hospital management to promote appropriate use of antimicrobial drugs**

- 1. Drug selection**
- 2. Restrict drugs**
- 3. Bacteriology laboratory facility**
- 4. Antimicrobial guideline**
- 5. Surgical prophylaxis policy**
- 6. Education program**
- 7. Monitoring of drug use**
- 8. Hospital infection control**

**(National Workshop 1995 by FDA Thailand & INRUD)**

**Guideline**



**Implementation**



**Evaluation**



# Antibiotic Order Form (AOF)

**AOF** as a strategy to control use of restricted antibiotics in admitted patients when immediate consultation is not possible.

Sirinavin S, Suvanakoot P, Satapathayavongs B, Malatham K.  
Effect of antibiotic order form guiding rational use of expensive drugs.  
Southeast Asian J Trop Med Public Health 1998



# Antibiotic Order Form

## Objectives:

1. Education
2. Audit
3. Surveillance

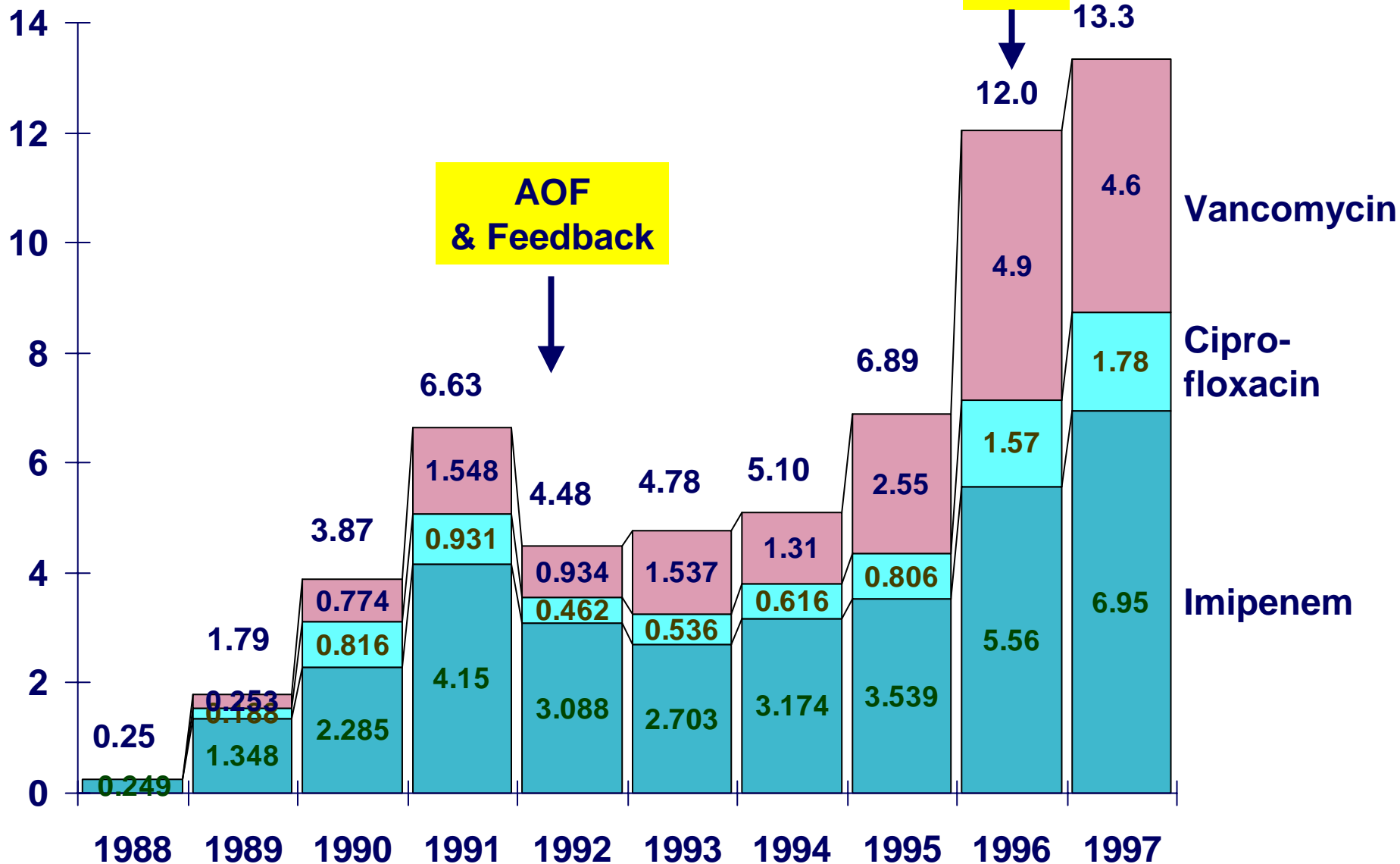
# **Antibiotic Order Form (AOF) for restricted drugs (Ramathibodi Hospital, Bangkok)**

**Information needed to be filled in AOF  
before the restricted antibiotics were  
dispensed from hospital pharmacy**

- Patient's profile**
- Site of infection**
- Suspected causative organism**
- Microbiology investigation**
- Reasons for using the restricted drug**

# Annual Expense on Restricted Antibacterial Drugs Ramathibodi Hospital, Bangkok, 1988-1997

Million Baht



## **Lesson learned :**

**AOF is helpful for busy ID consultants.  
It does not work without auditing  
and feedback.**

**It did not prohibit physician's  
prescription therefore it did not  
compromise patient care.**

# Consumers

**Consumers have high expectations in the power of pharmaceuticals and demand them from health practitioners.**

**Consumers' demand for medicines benefit prescribers, dispensers, and manufacturers.**

**Decreased patients' demand are likely to make them unpopular with the population, reduce the numbers of clients, and reduce their income.**

**Health professionals are trained to cure with pills, and consultation time is shortened by prescribing medicines rather than explaining alternative behavioral therapies.**

**Homedes N, Ugaldeb A. Soc Sci Med 2001;52:99**

# **Promoting appropriate use of antimicrobial drugs in Specific Disease Management**

- **Acute respiratory tract infection**
- **Acute diarrhea**
- **Sexually transmitted disease**

# Some of activities to promote appropriate antimicrobial use in Thailand

---

- 1995 : Pilot project for improving antibiotic use in hospitals, MOPH**
- 1995 : National antibiotic guideline**
- 1995 : Workshop for the MOPH hospitals on strategies for improving antibiotic use in hospitals  
(supported by Thai FDA and INRUD)**
- 1995 : Committee on development of practice guideline for the Pharmacy and Therapeutic Committee, MOPH**
- 1997 : Committee on quality improvement of microbiology laboratory, MOPH**



# Some of activities to promote appropriate antimicrobial use in Thailand

---

- 1998 : National program on controlling non-typhoidal *Salmonella***
- 1999 : National program for surveillance on antimicrobial resistance in humans**
- 1999 : Center for Antimicrobial Resistance Monitoring of Foodborne Pathogens**
- 2001: National Program for Antimicrobial Resistance Monitoring in Food-borne pathogens**
- 2001: National program for promoting prudent use of antimicrobial drugs in food animals**
- 2001 : Evidence-based clinical practice guideline for prevention and treatment of communicable disease**

# **More interdisciplinary collaboration in promoting appropriate antimicrobial use**

- Medical doctors**
- Veterinarians**
- Pharmacists (ID pharmacists)**
- Drug sellers**
- Microbiologists**
- Consumers (e.g. AIDS / HIV)**
- Ministry of public health and medical schools**

# Summary

**Some activities to promote appropriate use of antimicrobial drugs in a developing country are presented, including:**

- Drug selection into National Drug List**
- Support for etiologic diagnosis**
- National antimicrobial guideline**
- Control of restricted broad-spectrum antimicrobials**
- Infra-structure development**

# Summary

**Success in improving antimicrobial use and prevention of drug resistance problem is still not achievable.**

**Strong and long-termed policy and support are needed.**

