Efficacy of Antibiotic (Restriction) Policies and «*Stewardship*»

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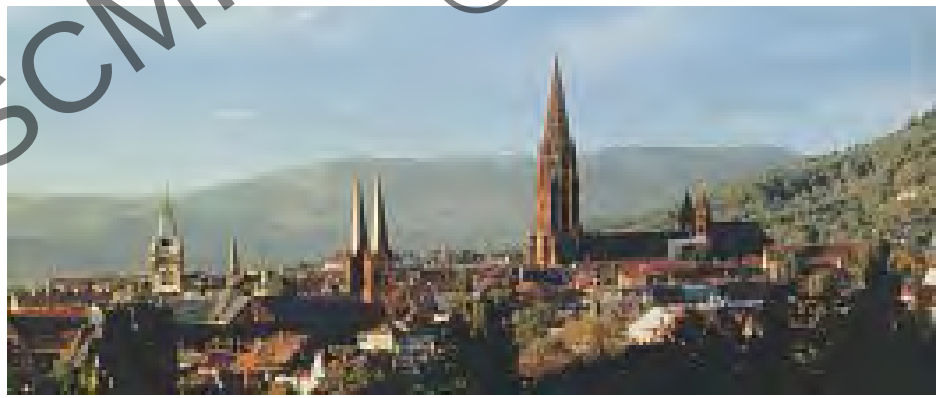

“The development of new antibiotics without having mechanisms to ensure their appropriate use is much like supplying your alcoholic patients with a finer brandy.“

Dennis Maki 1998

… key documents

CLINICAL MICROBIOLOGY REVIEWS, Oct. 2005, p. 638–656 Vol. 18, No. 4
0893-8512/05/$08.00+0 doi:10.1128/CMR.18.4.638–656.2005

Antimicrobial Stewardship Programs in Health Care Systems

Conan MacDougall* and Ron E. Polk

Department of Pharmacy, School of Pharmacy, Virginia Commonwealth University, Medical College of Virginia Campus, Richmond, Virginia 23298

… key documents

Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America Guidelines for Developing an Institutional Program to Enhance Antimicrobial Stewardship

Timothy H. Dellit,[1] Robert C. Owens,[2] John E. McGowan, Jr.,[3] Dale N. Gerding,[4] Robert A. Weinstein,[5] John P. Burke,[6] W. Charles Huskins,[7] David L. Paterson,[8] Neil O. Fishman,[9] Christopher F. Carpenter,[10] P. J. Brennan,[9] Marianne Billeter,[11] and Thomas M. Hooton[12]

Clinical Infectious Diseases 2007; 44:159–77

… key documents

Policy Statement on Antimicrobial Stewardship by the Society for Healthcare Epidemiology of America (SHEA), the Infectious Diseases Society of America (IDSA), and the Pediatric Infectious Diseases Society (PIDS)

Society for Healthcare Epidemiology of America; Infectious Diseases Society of America; Pediatric Infectious Diseases Society

Antimicrobial resistance has emerged as a significant healthcare quality and patient safety issue in the twenty-first century that, combined with a rapidly dwindling antimicrobial armamentarium, has resulted in a critical threat to the public health of the United States. Antimicrobial stewardship programs optimize antimicrobial use to achieve the best clinical outcomes while minimizing adverse events and limiting selective pressures that drive the emergence of resistance and may also reduce excessive costs attributable to suboptimal antimicrobial use. Therefore, antimicrobial stewardship must be a fiduciary responsibility for all healthcare institutions across the continuum of care. This position statement of the Society for Healthcare Epidemiology of America, the Infectious Diseases Society of America, and the Pediatric Infectious Diseases Society of America outlines recommendations for the mandatory implementation of antimicrobial stewardship throughout health care, suggests process and outcome measures to monitor these interventions, and addresses deficiencies in education and research in this field as well as the lack of accurate data on antimicrobial use in the United States.

Infect Control Hosp Epidemiol 2012;33(4):322-327

Quality prescribing density *vs* cost

„poor quality“ or „inadequate“ antibiotic prescriptions

… a US-american study with 34,133 cases reported that

- 93% of surgical patients were given a perioperative prophylactic antibiotic according to current guidelines
- only 56% received this regimen within the correct timeframe
- in only 41% antibiotics were discontinued within 24 hours

Bratzler et al *Arch Surg* 2005

… European data (ESAC-PPS 2006*)

Table 4. Duration of Surgical Prophylaxis for Patients in Surgical Departments

Department	Duration of prophylaxis, no of patients			Total no of patients	Duration of prophylaxis, % of total by department		
	1 Dose	1 Day	>24 h		1 Dose	1 Day	>24 h
General Surgery	66	36	137	244	27.0	14.8	56.1
Orthopedics	14	32	43	89	15.7	36.0	48.3
Gynecology	32	5	34	71	45.1	7.0	47.9
Urology	7	6	43	56	12.5	10.7	76.8
Otorhinolaryngology	2	1	27	30	6.7	3.3	90.0
Pediatrics	8	4	9	21	38.1	19.0	42.9
Overall (all departments)	129	84	293	511	25.2	16.4	57.3

*20 hospitals, 11,571 patients, 30% with antibiotics

Ansari et al *CID* 2009

Burden of hospital-wide „inadequate“ antibiotic prescriptions

• 9%	n=776	Turkey 2009
• 11%	n=107	France 2003
• 15%	n=104	France 2009
• 20%	n=1079	UK 2007
• 20%	n=2306	Israel 2001
• 22-27%	n=539	Switzerland 2007
• 24%	n=166	Spain 2003
• 29%	n=493	Croatia, 2005
• 17-37%,	n=1270	Switzerland 2010
• 30%	n=129	USA 2003
• 31%	n=177	Italy 2008
• 35%	n=105	France 2003
• 36%	n=281	Turkey 2003
• 37%	n=938	Netherlands 2007
• 43%	n=189	Spain 2003
• 44%	n=378	Turkey 2005
• 47%	n=223	Turkey 2005
• 47%	n=173	Switzerland 2004
• 54%	n=156	Turkey 2000
• 64%	n=438	Croatia 2007
• 66%	n=122	France 2007

? how to improve ?

- more „experts“
- more interventions (?formulary, ?local guidelines, ?education, ?audits, ?stop orders, ?dedicated order forms, ?computerized physician order entry and decision support systems)

Systematic Review of Antimicrobial Drug Prescribing in Hospitals

Peter Davey,*† Erwin Brown,‡ Lynda Fenelon,§ Roger Finch,¶# Ian Gould,** Alison Holmes,††
Craig Ramsay,‡‡ Eric Taylor,§§ Phil Wiffen,¶¶ and Mark Wilcox,##***

Emerging Infectious Diseases • www.cdc.gov/eid • Vol. 12, No. 2, February 2006

- Cochrane Review
- Publications 1980 through 2003,
- 393 out of 743 papers not eligible
- 284 out of 350 eligible studies excluded
- 66 studies included (with acceptable methodology & evaluable)
- Various endpoints
- Different designs and interventions

Systematic Review of Antimicrobial Drug Prescribing in Hospitals

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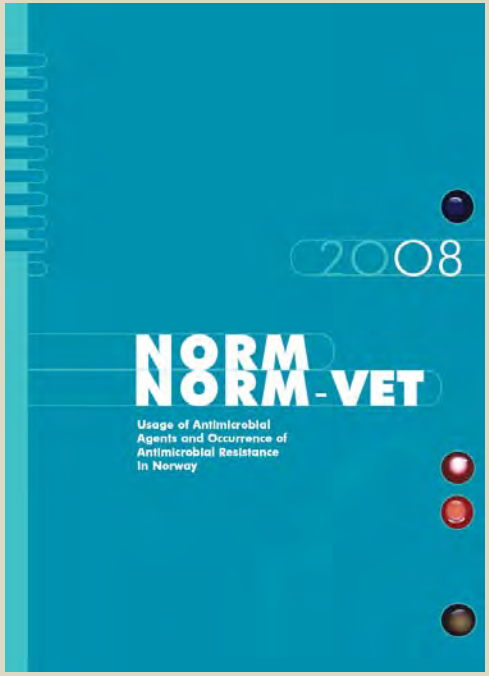
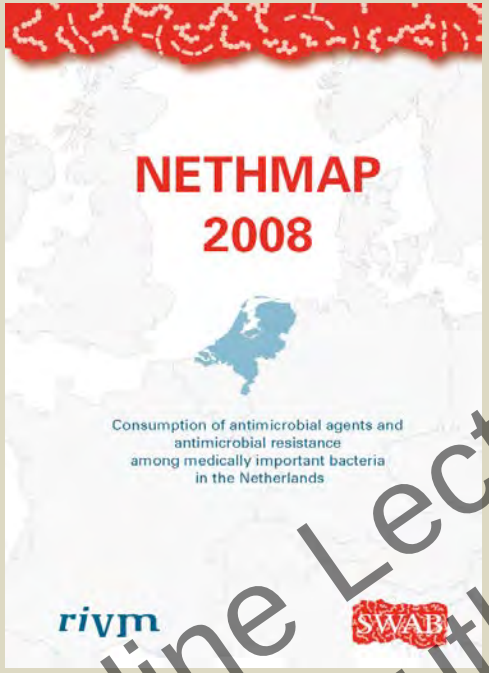
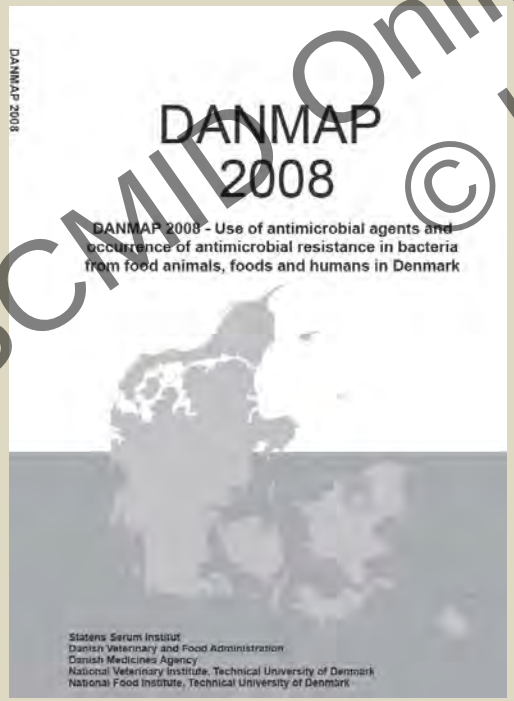
Emerging Infectious Diseases • www.cdc.gov/eid • Vol. 12, No. 2, February 2006

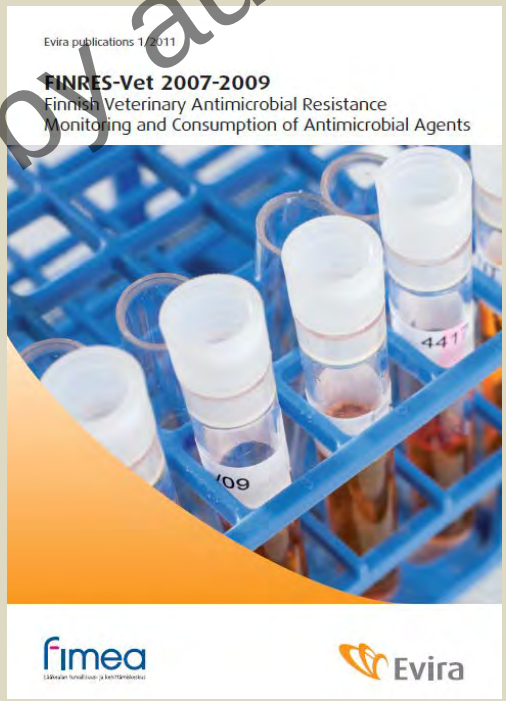
- Interventions: educational, ABx restriction, ...
- Most studies with treatment as endpoint (~75%) were „successful“
- Few studies with „microbiologic“ endpoints (CDAD, resistant gram-negatives, VRE, MRSA) were convincing (4/16)
- Effect size highly variable
- Best type of intervention unknown

Quality prescribing density *vs* cost









DANMAP 2010

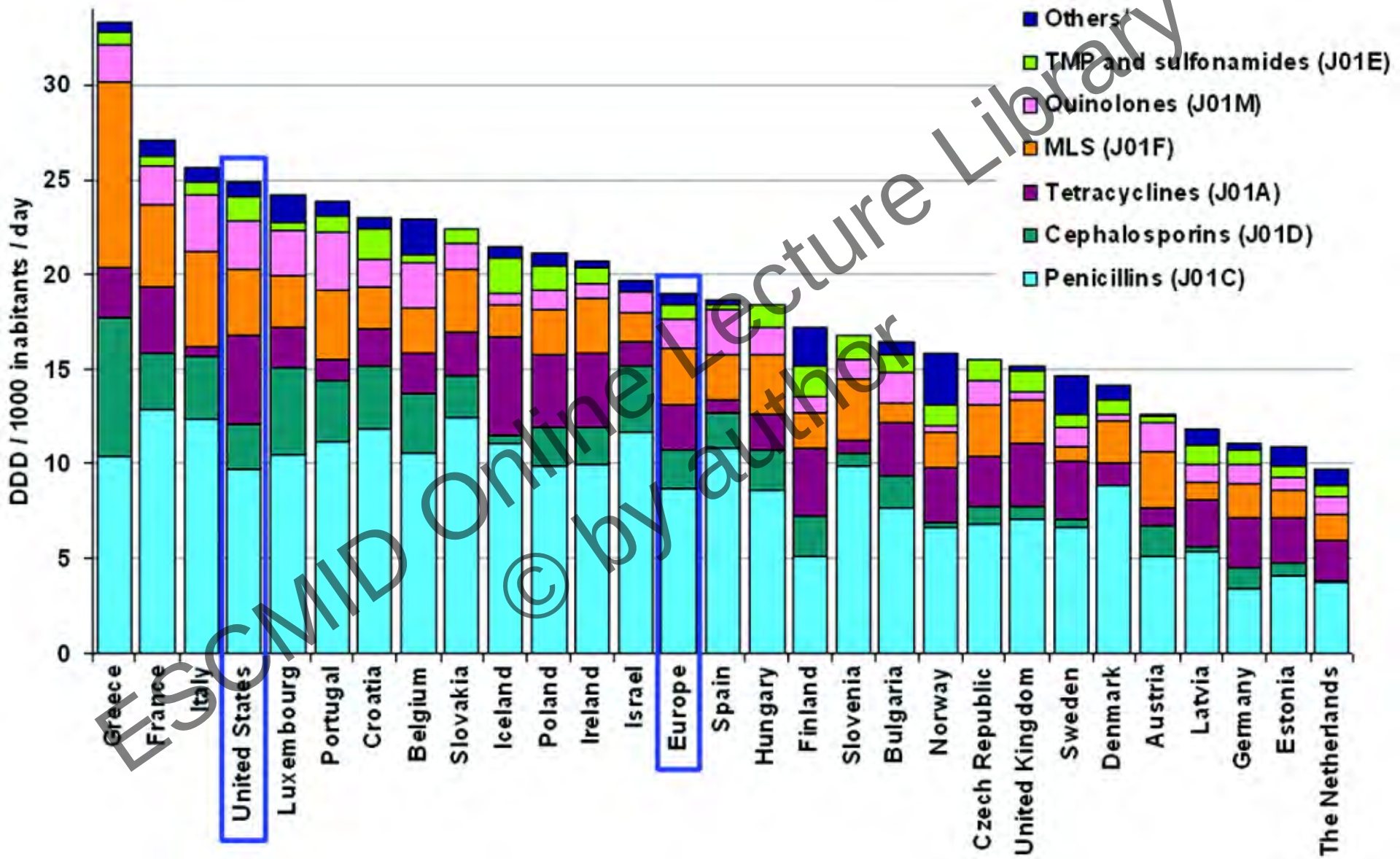
DANMAP 2010 - Use of antimicrobial agents and occurrence of antimicrobial resistance in bacteria from food animals, food and humans in Denmark

Statens Serum Institut
Danish Medicines Agency
National Veterinary Institute, Technical University of Denmark
National Food Institute, Technical University of Denmark

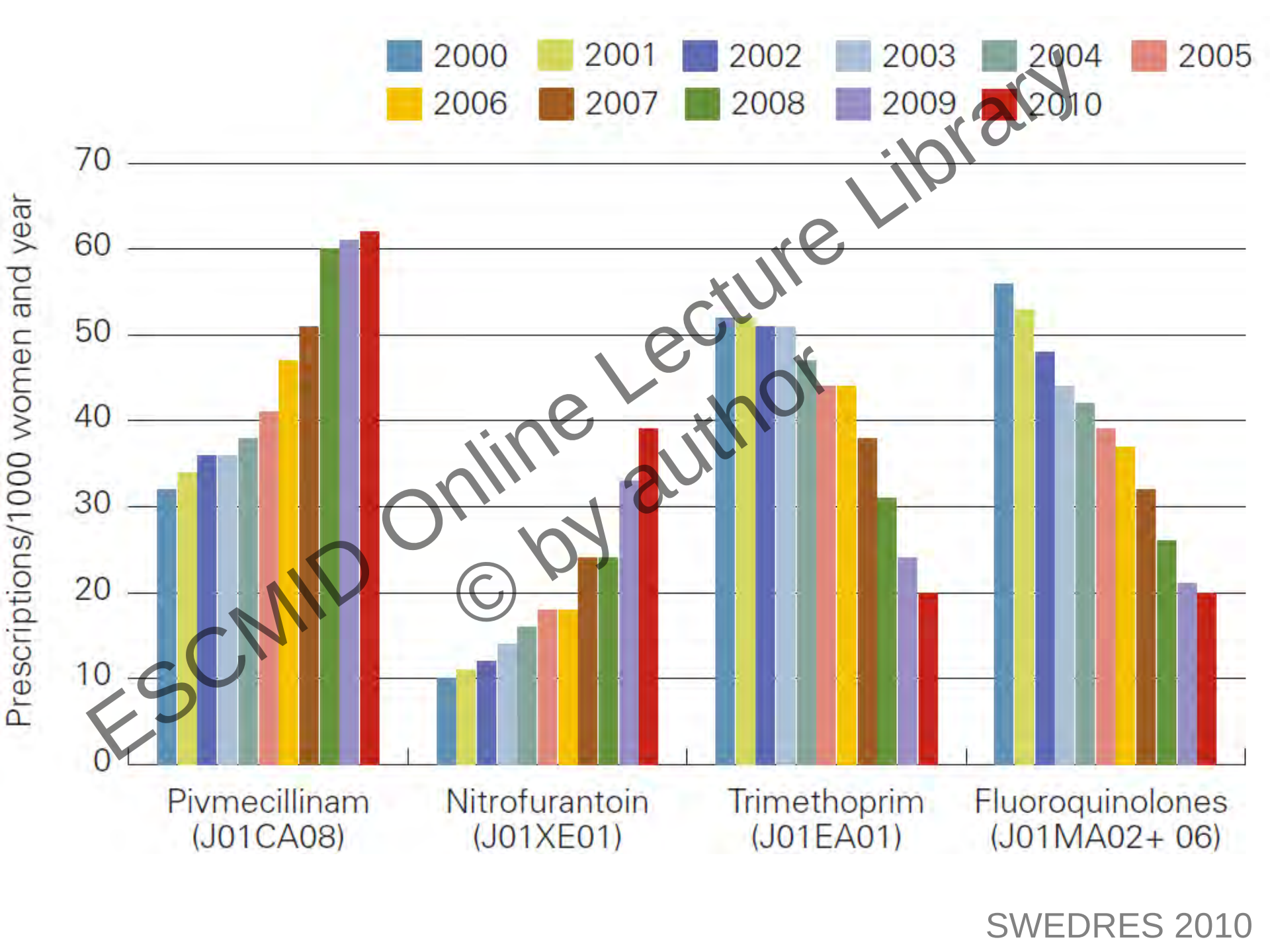
GERMAP 2010

Antibiotika-Resistenz und -Verbrauch

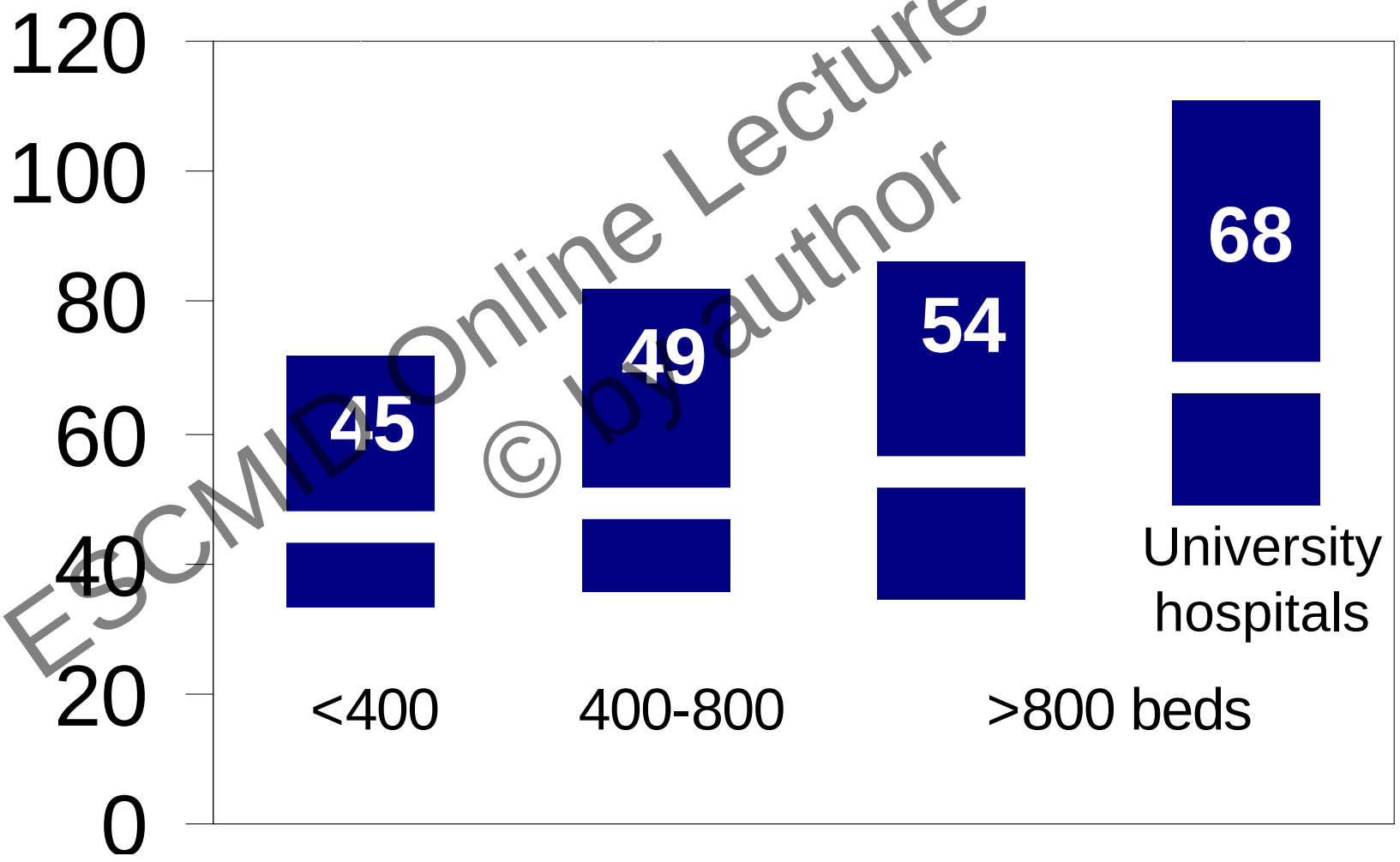
Bericht über den Antibiotikaverbrauch und die Verbreitung von Antibiotikaresistenzen in der Human- und Veterinärmedizin in Deutschland



ESAC, data for 2004



Antibiotic use density (median DDD/100 & IQR) ccording to hospital size & affiliation

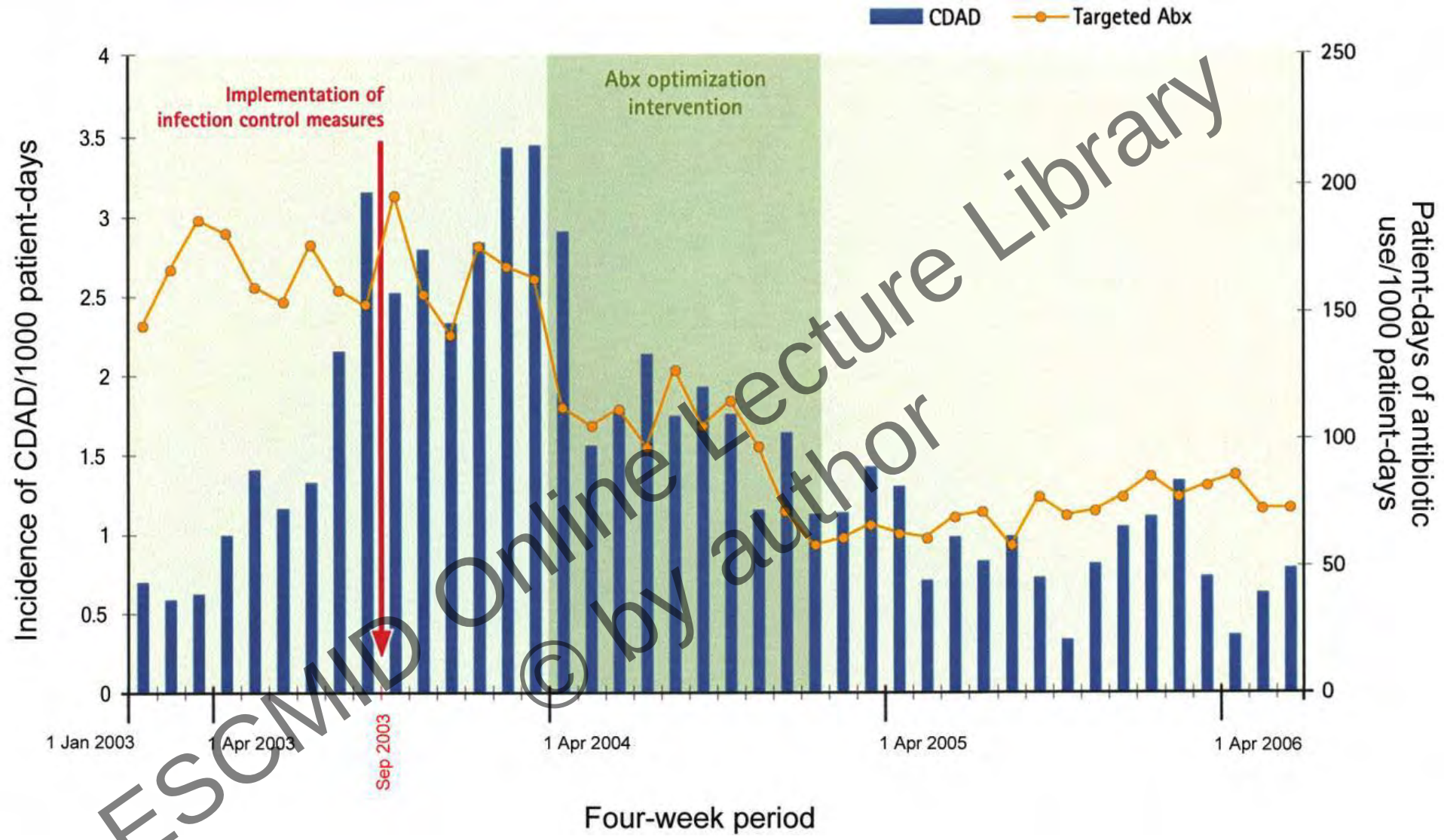


Data source: IMS Health, data for 2004

GERMAP*2008*

Surveillance of hospital antibiotic use

- … should be done in YOUR hospital
- … should be done as a sentinel system in your region or country
- … can be adapted to answer quality improvement research questions



Impact of a Reduction in the Use of High-Risk Antibiotics on the Course of an Epidemic of *Clostridium difficile*–Associated Disease Caused by the Hypervirulent NAP1/027 Strain

Valiquette et al *CID* 2008

Surveillance of antibiotic use

- DDD = defined daily dose
  = numerator
  = needs a denominator
  population exposed at a given time
  - general population (per 1000 pop & day)
  - patients admitted (general ward and/or ICU)
    (per 100 patient days & month/quarter/year)
    (per 100 admissions or discharges & …)

Surveillance of antibiotic use

- *Note!*

  “patient days” as denominator is greatly influenced by length of stay

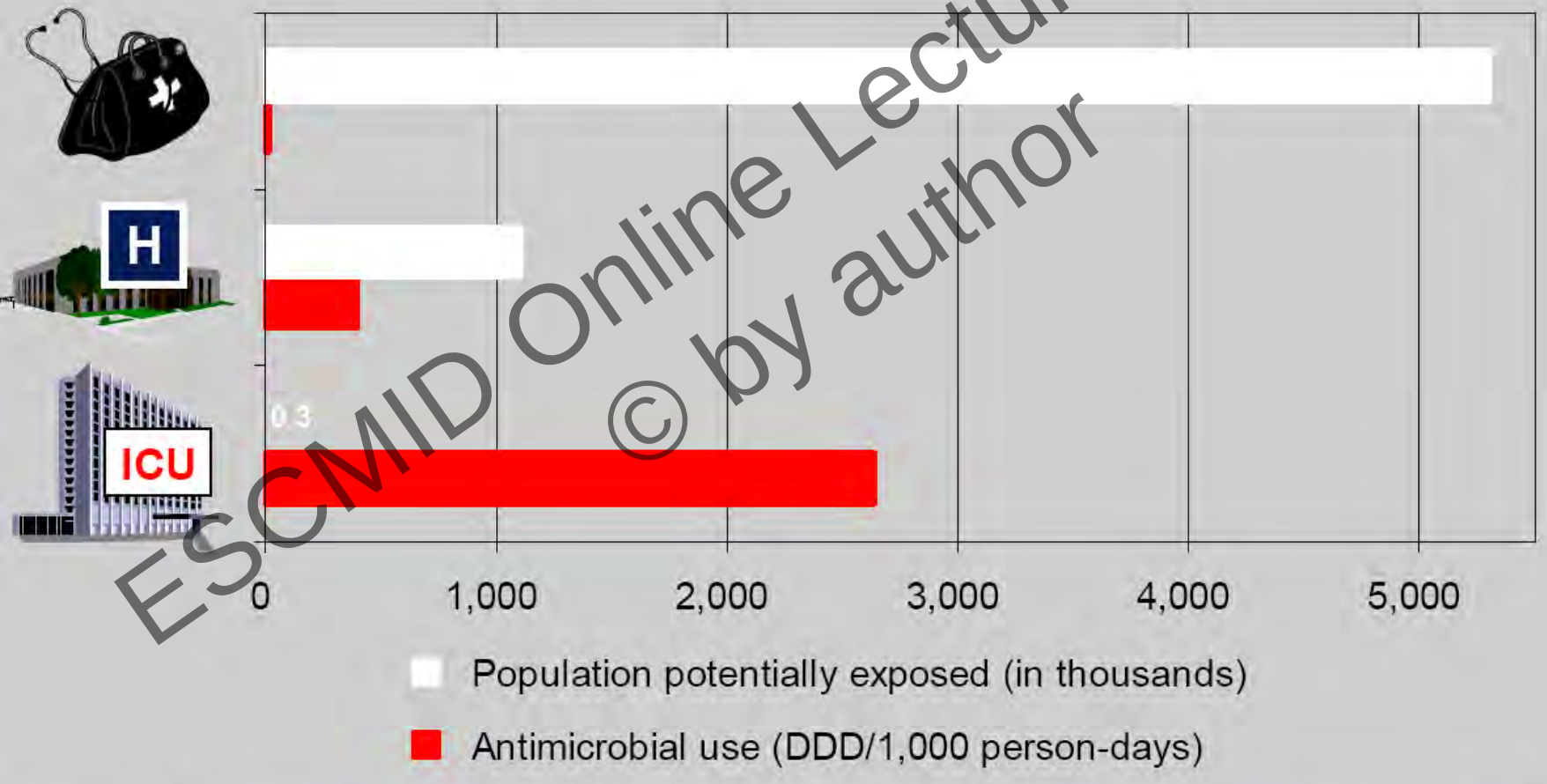
Antibiotic use density (DDD/100 patient days) according to hospital ward type

	Median (IQR)	Weighted mean	Proportion (%)
Surgical ward (n=340)	40 (33-49)	46	48%
Non-surgical ward (n=285)	45 (36-56)	48	42%
Intensive care unit (n=218)	110 (87-141)	114	10%

Data source: IMS Health, data for 2004

STATENS SERUM INSTITUT

Antimicrobial Consumption in Denmark, 1997-99



Sources: DANMAP, Danish National Board of Health, and Petersen IS, et al. APMIS 1999;107: 989-996.

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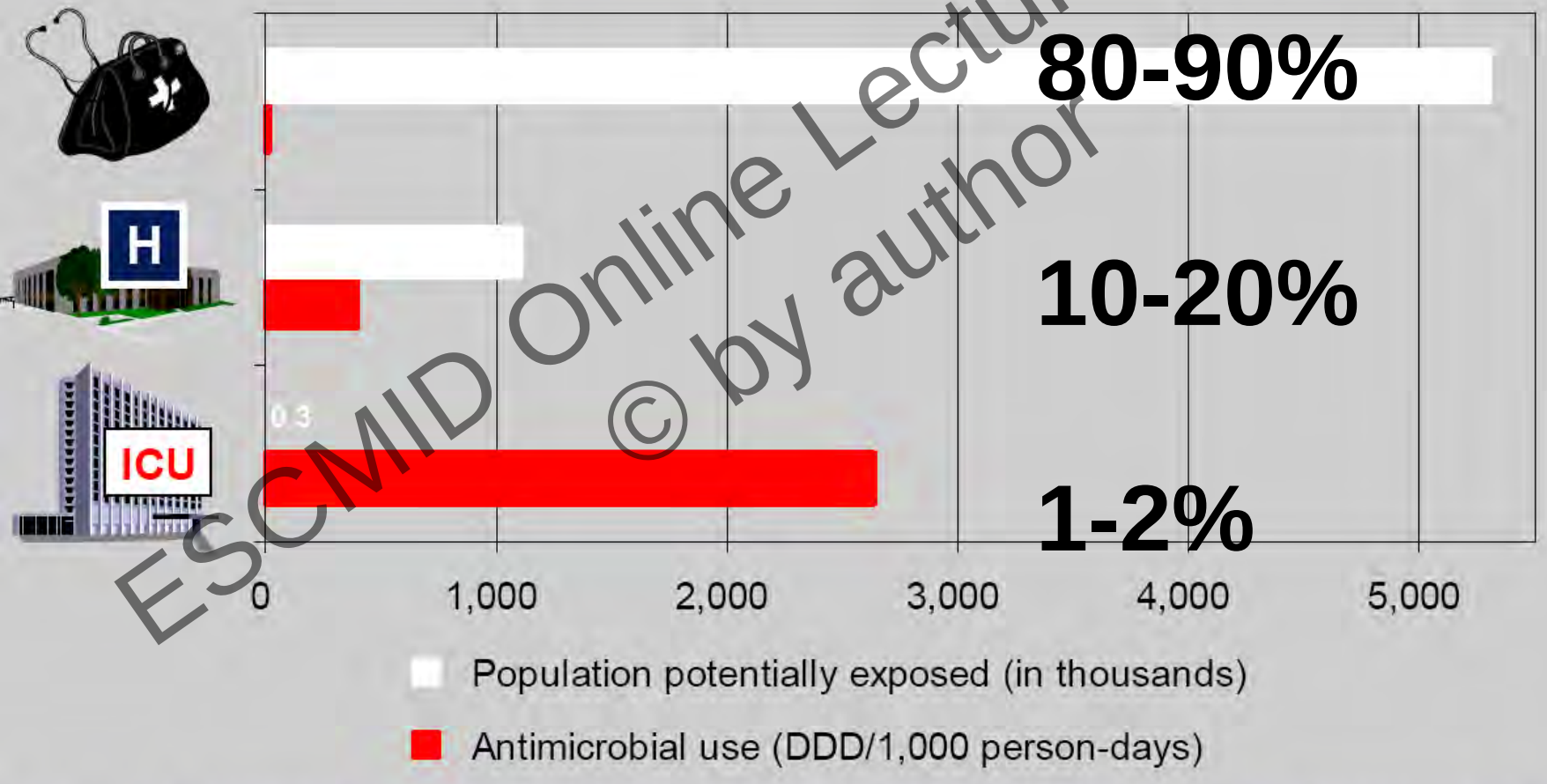

Sources: DANMAP, Danish National Board of Health, and Petersen IS, et al. APMIS 1999;107: 989-996.

Antibiotic use: numerators

- DDD: defined by the WHO CollaboratingCentre for Drug Statistics Methodology, Oslo (Norway)
- = average maintenance dose (main indication, adult of 70 kg)
- Grams (or IU) of active substance
- Technical measurement unit that allows comparisons (!?)
- not strictly needed if patient level data available (individual vs group)

WHO Collaborating Centre for Drug Statistics Methodology

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International language for drug utilization research

ATC/DDD

The Anatomical Therapeutic Chemical (ATC) classification system and the Defined Daily Dose (DDD) as a measuring unit have become the gold standard for international drug utilization research.

The ATC/DDD system is a tool for exchanging and comparing data on drug use at international, national or local levels.

Welcome to the WHO Collaborating Centre for Drug Statistics Methodology

Please note that the Centre will be closed in week 30 (26 July - 1 August) during summer holiday. Have a nice summer!

Last updated: 2010-07-01

News

ATC/DDD course 6-7 June 2011
Read

Updates - new ATC/DDDs and alterations
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New website
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Guidelines for ATC/DDD assignment - 2010
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DDD alterations from 1982-2010

Cumulative overview of all DDD alterations performed in the period 1982-2010. The year changed is when the alterations were implemented in the ATC/DDD Index. Please note that a DDD may have changed more than once for some ATC codes. The ATC codes are current codes. For substances where the DDD is changed twice the new DDD which is not according to current value is marked with an asterix (*).

List of abbrevations

Substance	Previous DDD			New DDD*			Present ATC code	Year changed
Acebutolol	0.6	g	O,P	0.4	g	O,P	C07AB04	1987
Aciclovir	1	g	O,P	4	g	O,P [1)]	J05AB01	1995
Alosetron	2	mg	O	1	mg	O	A03AE01	2005
Amoxicillin and enzyme inhibitor	1	g	P	3	g	P	J01CR02	2005
Amprenavir	2.4	g	O	1.2	g	O	J05AE05	2006
Amrinone	0.15	g	P	0.5	g	P	C01CE01	1991
Atenolol	0.1	g	O,P	75	mg	O,P	C07AB03	1995
Atorvastatin	10	mg	O	20	mg	O	C10AA05	2009
Azlocillin	6	g	P	12	g	P	J01CA09	1991
Beclomethasone inhal aer/powd.	0.4	mg		0.8	mg		R03BA01	1991
Benazepril	20	mg	O	7.5	mg	O	C09AA07	1995
Benzylpenicillin	2	MU	P	3.6	MU	P [2)]	J01CE01	1991
Bezitramide	10	mg	O	15	mg	O	N02AC05	2004
Budesonide	0.3	mg	N	0.2	mg	N	R01AD05	2003
Budesonide inhal. aer/powd.	0.3	mg		0.8	mg		R03BA02	1991
Cabergoline	1	mg	O	0.5	mg	O	G02CB03	1997
Cabergoline	4	mg	O	3	mg	O	N04BC06	2001
Captopril	0.15	g	O	50	mg	O	C09AA01	1989
Carbocisteine	1	g	O	1.5	g	O	R05CB03	1997

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Alosetron	2	mg	O	1	mg	O	A03AE01	2005
Amoxicillin and enzyme inhibitor	1	g	P	3	g	P	J01CR02	2005
Amprenavir	2.4	g	O	1.2	g	O	J05AE05	2006
Amrinone	0.15	g	P	0.5	g	P	C01CE01	1991
Atenolol	0.1	g	O,P	75	mg	O,P	C07AB03	1995
Atorvastatin	10	mg	O	20	mg	O	C10AA05	2009
Azlocillin	6	g	P	12	g	P	J01CA09	1991
Beclomethasone inhal aer/powd.	0.4	mg		0.8	mg		R03BA01	1991
Benazepril	20	mg	O	7.5	mg	O	C09AA07	1995
Benzylpenicillin	2	MU	P	3.6	MU	P [2)]	J01CE01	1991
Bezitramide	10	mg	O	15	mg	O	N02AC05	2004
Budesonide	0.3	mg	N	0.2	mg	N	R01AD05	2003
Budesonide inhal. aer/powd.	0.3	mg		0.8	mg		R03BA02	1991
Cabergoline	1	mg	O	0.5	mg	O	G02CB03	1997
Cabergoline	4	mg	O	3	mg	O	N04BC06	2001
Captopril	0.15	g	O	50	mg	O	C09AA01	1989
Carbocisteine	1	g	O	1.5	g	O	R05CB03	1997

Carvedilol	50	mg	O	37.5	mg	O	C07AG02	1995
Cefaclor	2	g	O	1.5	g	O*	J01DC04	1992
Cefaclor	1.5	g	O	1	g	O	J01DC04	2000
Cefaloridine	2	g	P	3	g	P	J01DB02	1992
Cefamandole	2	g	P	6	g	P	J01DC03	1992
Cefatrizine	2	g	O	1	g	O	J01DB07	2000
Cefazolin	2	g	P	3	g	P	J01DB04	1992
Cefepime	4	g	P	2	g	P	J01DE01	2000
Cefoperazone	2	g	P	6	g	P*	J01DD12	1992
Cefoperazone	6	g	P	4	g	P	J01DD12	2000
Cefotaxime	2	g	P	6	g	P*	J01DD01	1992
Cefotaxime	6	g	P	4	g	P	J01DD01	2000
Cefotetan	2	g	P	4	g	P	J01DC05	1992
Cefotiam	2	g	P	4	g	P	J01DC07	1992
Cefoxitin	2	g	P	6	g	P	J01DC01	1992
Cefradine	3	g	O,P	2	g	O,P	J01DB09	1992
Cefsulodin	4	g	P	6	g	P*	J01DD03	1992
Cefsulodin	6	g	P	4	g	P	J01DD03	2000
Ceftazidime	4	g	P	6	g	P*	J01DD02	1992
Ceftazidime	6	g	P	4	g	P	J01DD02	2000
Ceftezole	6	g	P	3	g	P	J01DB12	2008
Ceftizoxime	2	g	P	4	g	P	J01DD07	1992
Cefuroxime	1	g	O	0.5	g	O	J01DC02	2000
Cefuroxime	4	g	P	3	g	P	J01DC02	2000
Cimetidine	1	g	O,P	0.8	g	O,P	A02BA01	1989
Ciprofloxacin	1	g	P	0.5	g	P	J01MA02	1992
Clobutinol	0.3	g	O,P	0.12	g	O,P	R05DB03	1987
Conjugated estrogens	1.25	mg	O	0.625	mg	O	G03CA57	1995
Cromoglicic acid inhal aersol	8	mg		40	mg		R03BC01	1991
Dalteparin	25	TU	P	3	TU	P*	B01AB04	1993
Dalteparin	3	TU	P	2.5	TU	P	B01AB04	2000
Danaparoid	25	TU	P	3	TU	P*	B01AB09	1993
Danaparoid	3	TU	P	1.5	TU	P	B01AB09	2000
Dapsone	0.125	g	O	50	mg	O	J04BA02	1991
Desmopressin	0.36	mg 1)	SL	0.24	mg 1)	SL	H01BA02	2009
Dexibuprofen	1	g	O	0.8	g	O	M01AE14	2000
Dipyridamole	0.15	g	O	0.4	g	O	B01AC07	1991
Dipyridamole	0.15	g	P	0.2	g	P	B01AC07	1991
Doxazosin	8	mg	O	4	mg	O	C02CA04	1992

Carvedilol	50	mg	O	37.5	mg	O	C07AG02	1995
Cefaclor	2	g	O	1.5	g	O*	J01DC04	1992
Cefaclor	1.5	g	O	1	g	O	J01DC04	2000
Cefaloridine	2	g	P	3	g	P	J01DB02	1992
Cefamandole	2	g	P	6	g	P	J01DC03	1992
Cefatrizine	2	g	O	1	g	O	J01DB07	2000
Cefazolin	2	g	P	3	g	P	J01DB04	1992
Cefepime	4	g	P	2	g	P	J01DE01	2000
Cefoperazone	2	g	P	6	g	P*	J01DD12	1992
Cefoperazone	6	g	P	4	g	P	J01DD12	2000
Cefotaxime	2	g	P	6	g	P*	J01DD01	1992
Cefotaxime	6	g	P	4	g	P	J01DD01	2000
Cefotetan	2	g	P	4	g	P	J01DC05	1992
Cefotiam	2	g	P	4	g	P	J01DC07	1992
Cefoxitin	2	g	P	6	g	P	J01DC01	1992
Cefradine	3	g	O,P	2	g	O,P	J01DB09	1992
Cefsulodin	4	g	P	6	g	P*	J01DD03	1992
Cefsulodin	6	g	P	4	g	P	J01DD03	2000
Ceftazidime	4	g	P	6	g	P*	J01DD02	1992
Ceftazidime	6	g	P	4	g	P	J01DD02	2000
Ceftezole	6	g	P	3	g	P	J01DB12	2008
Ceftizoxime	2	g	P	4	g	P	J01DD07	1992
Cefuroxime	1	g	O	0.5	g	O	J01DC02	2000
Cefuroxime	4	g	P	3	g	P	J01DC02	2000
Cimetidine	1	g	O,P	0.8	g	O,P	A02BA01	1989
Ciprofloxacin	1	g	P	0.5	g	P	J01MA02	1992
Clobutinol	0.3	g	O,P	0.12	g	O,P	R05DB03	1987
Conjugated estrogens	1.25	mg	O	0.625	mg	O	G03CA57	1995
Cromoglicic acid inhal.	2	mg		10	mg		R03BC01	1991

Antibiotic use: numerators

- DDD
- recommended daily dose (*RDD*)

Class	Drug	WHO DDD	if RDD
NSB	Pen G	3,6g	12g
	Amp	2g	15g
	Amox po	1g	2,25g
	Fluclox iv	2g	8g
ISB	Cefurox iv	3g	4,5g
BSB	Cefta	4g	6g
	Pip	14g	12g
	Merop	2g	3g

Patient XY

- day 1: Cipro 3 x 400
- day 2: Cipro 2 x 400 Augmentin 3 x 2,2
- day 3: Cipro 1 x 400 Augmentin 3 x 2,2
- day 4: Cefepime 3 x 2
- … …
- day 7: Cefepime 3 x 2
- day 8: STOPP
- day 10 discharge

Patient XY

- day 1: Cipro 3 x 400 **1 PDD**
- day 2: Cipro 2 x 400 Meropenem 3 x 2,2 **1 PDD**
- day 3: Cipro 1 x 400 Meropenem 3 x 2,2 **1 PDD**
- day 4: Cefotaxime 3 x 2 **1 PDD**
- … **…**
- day 7: Cefotaxime 3 x 2 **1 PDD**
- day 8: STOPP
- day 10 discharge

= 9 PDD/10 patient days

Patient XY

- day 1: Cipro 3 x 400
- day 2: Cipro 2 x 400 Augmentin 3 x 2,2
- day 3: Cipro 1 x 400 Augmentin 3 x 2,2
- day 4: Cefepime 3 x 2
- … …
- day 7: Cefepime 3 x 2
- day 8: STOPP
- day 10 discharge

Patient XY

- day 1: Cipro 2 x 400 **2.4 DDD**
- day 2: Cipro 2 x 400 Amoxi/Clav 3 x 2,2 **2.0 DDD**
- day 3: Cipro 1 x 400 Amoxi/Clav 3 x 2,2 **2.0 DDD**
- day 4: Cefuroxime 3 x 2 **3.0 DDD**
- … **…**
- day 7: Cefuroxime 3 x 2 **3.0 DDD**
- day 8: STOPP
- day 10 discharge

= 24.6 DDD/10 patient days

Patient XY

- day 1: Cipro 2 x 400
- day 2: Cipro 2 x 400 Augmentin 3 x 2,2
- day 3: Cipro 1 x 400 Augmentin 3 x 2,2
- day 4: Cefotime 3 x 2
- …
- day 7: Cefotime 3 x 2
- day 8: STOPP
- day 10 discharge

1.5 RDD

1.0 RDD **1.0 RDD**

0.5 RDD **1.0 RDD**

1.0 RDD

…

1.0 RDD

= 9 RDD/10 patient days

Hospital department XY, year Z

- Augmentin iv 2.2 g: 1000 units
- Cipro iv 0.4 g: 3000 units
- Cefepime iv 2 g: 5000 units
- Vancomycin iv 0.5 g: 400 units
- Cipro po 0.5 g x 10: 500 units
- Cipro po 0.75 g x 10: 500 units
- Cefuroxime 1.5 g: 1000 units

Hospital department XY, year Z

- Augmentin iv 2.2 g: 1500 units **667 DDD**
- Cipro iv 0.4 g: 6000 units **2400 DDD**
- Cefepime iv 2 g: 10000 units **5000 DDD**
- Vancomycin iv 0.5 g: 400 units **100 DDD**
- Cipro po 0.5 g x 10: 500 units **2500 DDD**
- Cipro po 0.75 g x 10: 500 units **3750 DDD**
- Cefuroxime 1.5 g: 1000 units **500 DDD**

= 14917 DDD/30.000 patient days

= 50 DDD/100

Hospital department XY, year Z

- Augmentin iv 2.2 g: 3000 units **333 RDD**
- Cipro iv 0.4 g: 3000 units **1500 RDD**
- Cefepime iv 2 g: 10000 units **1667 RDD**
- Vancomycin iv 0.5 g: 400 units **100 RDD**
- Cipro po 0.5 g x 10: 500 units **1667 RDD**
- Cipro po 0.75 g x 10: 500 units **2500 RDD**
- Cefuroxime 1.5 g: 1000 units **333 RDD**

= 8100 RDD/30.000 patient days

= 27 RDD/100

Quality prescribing density *vs* cost

Get Smart for Healthcare

Impact of Antibiotic Stewardship Program Interventions on Costs

Reference	Setting	Key staff	Resources required	Intervention	Impact	Tools
Seligman SJ. Reduction in Antibiotic Costs by Restricting Use of Oral Cephalosporin. American Journal of Medicine. 1981, 71: 941-944	1472-bed municipal hospital, Brooklyn, New York, USA	infectious disease physicians, pharmacy	—	Restriction-All physicians wanting to prescribe cephalexin had to seek approval from ID physician.	Cost of cephalexin dispensed went from $314,105 to $4,166 over one year. Total reduction in antibiotic costs was 29% when adjusted for inflation.	—
Britton HL, Schwinghamer TL, Romano MJ. Cost Containment through restrictions of cephalosporins. American Journal of Hospital Pharm. 1981; 38: 1897-900.	500-bed teaching hospital, Pittsburgh, PA, USA	infectious disease service, pharmacists	$1500 annually for monitoring program	Guidelines - Establishment of guidelines that cefazolin is cephalosporin of choice. Physicians contacted if orders deemed to be noncompliant.	Total purchases of cephalosporins decreased by $55,715 or 46.2% in first 12 months of program. Purchase costs for cephalosporins decreased from $0.921 per patient day to $0.519 (43.6%) per patient after the study period. Number of milligrams of cephalosporins used per patient day decreased from 398.16 to 178.77 (55.1%) while number of patient days decreased by 4.45%.	guidelines for cephalosporin use
Hayman JN, Sbravati. Controlling cephalosporin and aminoglycoside costs through pharmacy and therapeutics committee	545-bed, state-supported, tertiary-care teaching	Pharmacy, Pharmacy and Therapeutics Committee	—	Guidelines - Established restrictions on use of 2nd generation cephalosporins and aminoglycosides requiring	Second generation cephalosporin use decreased 52.2%, tobramycin decreased by 75.9% while unrestricted gentamicin increased 229%	—

Get Smart for Healthcare

Get Smart for Healthcare
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Impact of Antibiotic Stewardship Program Interventions on Costs

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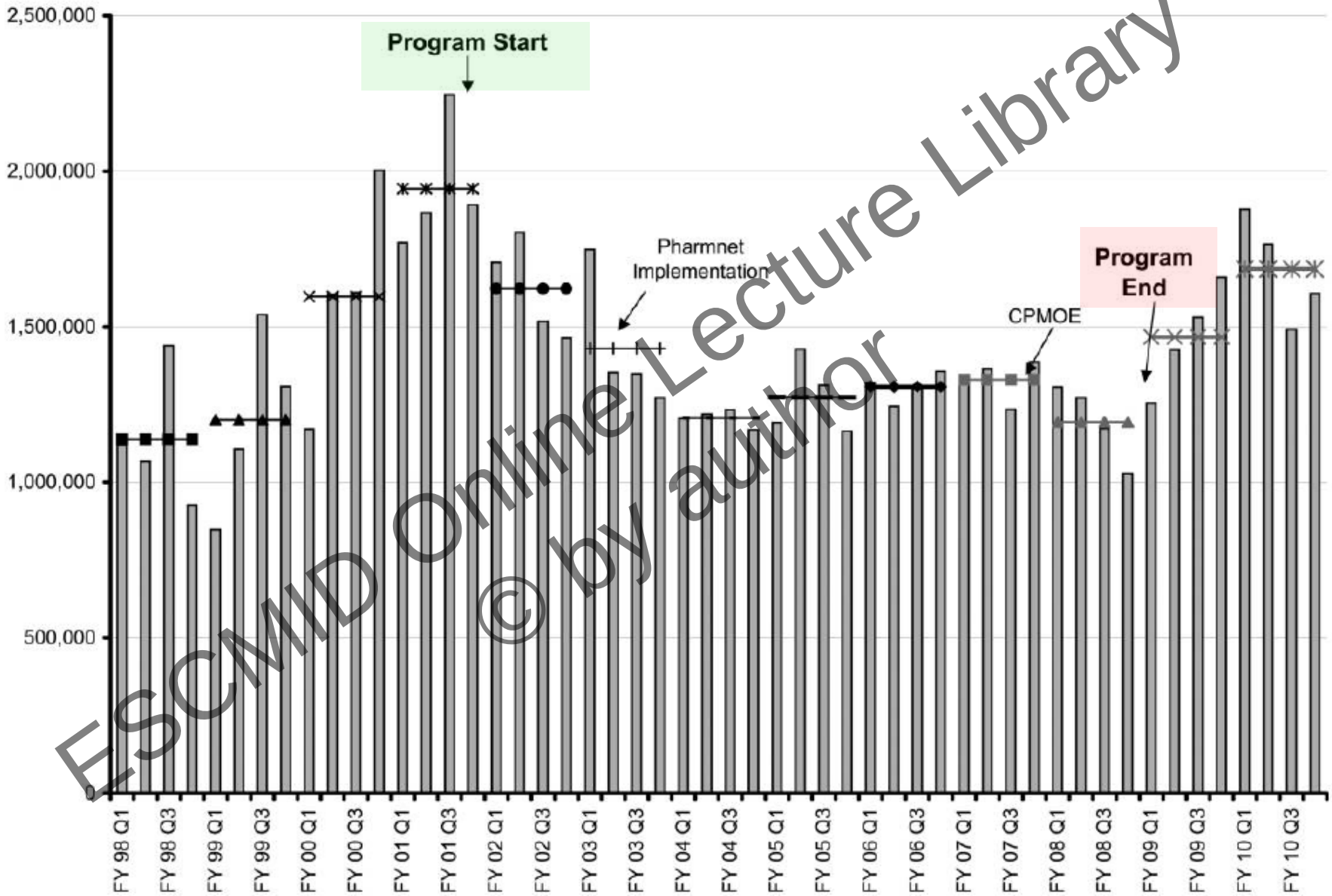

Standiford et al *ICHE* 2012

ABS: cost efficiency

- Decreased drug expenditures (US$)
  - first 3 years: 2.9 Mio 983,235/yr
  - first 5 years: 2.5 Mio 509,420/yr
  - first 7 years: 3.0 Mio 428,275/yr
- „Cost “ Programme STOP
  - First 2 years: 2.0 Mio 983,143/yr

Standiford et al *ICHE* 2012

ABS: cost efficiency

- Personnel expenditures
  - 25→ 50% ID physician
  - 80% Pharmacist (ABS-trained)
  - 5% IT specialist/data manager

Standiford et al *ICHE* 2012

ABS: cost efficiency

- Personnel expenditures
  - 25→ 50% ID physician
  - 80% Pharmacist (ABS-trained)
  - 5% IT specialist/data manager

~1.2 positions per 400 beds

~0.6 positions per 250 beds
~1.5 positions per 500 beds
~3.0 positions per 1000 beds

Standiford et al *ICHE* 2012

ABS: cost efficiency

- ~decreased drug expenditures (US$)
  - first 2-3 years:

    983,235 per yr

- ~programme (personnel) costs (US$)
  - first 2-3 years:

    200,000 per yr

Standiford et al *ICHE* 2012

ABS: cost efficiency

- ~decreased drug expenditures (US$)
  - first 2-3 years:

    ~2,500 per bed&yr

- ~programme (personnel) costs (US$)
  - first 2-3 years:

    ~500 per bed&yr

Standiford et al *ICHE* 2012

„Case studies“

Cusini et al PLoS One 2011

- Inadequate prescriptions

Talpaert et al JAC 2011:

- Guidelines & C. difficile

Dumartin et al JAC 2011

- ABS programmes & antibiotic use

Scheetz et al JAC 2009

- Cost-effectiveness - ABS programme & BSI infection