

Economic Impact of Healthcare-Associated Infection in Low and Middle Income Countries
Prof. Dr. Ata Nevzat Yalçın, Akdeniz University, Turkey
Teleclass sponsored by WHO Clean Care is Safer Care

Economic impact of healthcare-associated infections in low and middle-income countries

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Hosted by Prof. Emine Alp
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 WHO Patient Safety Challenge
 Clean Care is Safer Care

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Healthcare-associated infections

- Healthcare-associated infections (HAI) represent an important public health problem in developing countries as in developed ones today as a major cause of high morbidity, mortality and economic consequences in hospitalized patients.

Jarvis WR. *Infect Control Hosp Epidemiol* 1996;17: 552-7 2

Importance of Healthcare-associated infections

- The burden of Healthcare-associated infections (HAIs) is substantial in developed countries, where it affects from 5% to 15% of hospitalized patients in regular wards, and as many as 50% or more of patients in intensive care units (ICUs).
- The incidence of HAIs is between 25% and 40% in developing countries.
- HAIs increase length of stay in hospital.
- HAIs increase costs.
- HAIs increase mortality.

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Points of This Talk

- Incidence of HAI and cost
- Pharmacoeconomical analysis
- Excess cost
- Excess cost in HAI
- Cost of antibiotics
- Extra length of stay
- Extra mortality

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Healthcare-associated infections

- **Germany** → 525.000-800.000 cases
~ 20.000- 40.000 deaths
- **UK** → 500.000-1.000.000 cases
~ 5.000 deaths
- **USA** → 2.220.000 cases
~ 100.000 deaths
- **EU** → 4.500.000 cases
~ 111.000 deaths

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Excess Cost of Healthcare-associated Infections

- Norway → → 132 Million Dollars
- Scotland → → 168 Million Pounds
- England → → 1,7 Billion Dollars
- France → → 3-5 Billion Franks
- USA → → 7,7 (16,6 ???) Billion Dollars
- EU → → 7 Billion Euros
- Turkey → → 1-1,5 Billion Dollars ???

Andersen BM, et al. *Infect Control Hosp Epidemiol* 1998;19: 885-7
 Adalgröns P, et al. *J Hosp Infect* 1999; 42 : 303-12
 Plowman R, et al. *J Hosp Infect* 2001;47: 198-207
 Graves H. *Emerg Infect Dis* 2004;10: 561-6
 E CDC Annual Report 2006: 16-38
 Dickson D J, et al. *JAMA* 2008;299:1190-2
 Hassan M, et al. *Hospital Topics* 2010;88:82-9

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Healthcare-associated Infections and mortality
(US Department of Health and Human Services (DHHS-2009))

- Pneumonias → → 35,967
- Bloodstream inf. → → 30,655
- Urinary tract inf. → → 8,225
- Surgical site inf. → → 13,088
- Others → → 12,085
- **TOTAL** → → **100,000**

Stone PW. *Expert Rev Pharmacoecon Outcomes Res* 2009;9:417-22 7

Calculating costs
(Methodological subjects-1)

- Study design
- Patient group (incidence, prevalence, epidemics)
- Location (hospital, follow-up after discharge)
- Dimension of the study (hospital, country, developing countries, pathogens, interventions)

Wilcox MH, et al. *J Hosp Infect* 2000;45:81-4 8

Calculating costs
(Methodological subjects-2)

- Extra cost and design of length of stay
- Costs (hospital charges, deaths, antibiotics utilisation, antibiotic resistance, environmental damage)
- Conclusion statistics (mean, median, percent, total)
- Design of analysis

Wilcox MH, et al. *J Hosp Infect* 2000;45:81-4 9

Costs

1. Well described costs associated with healthcare-associated infections
2. Poorly described costs associated with healthcare-associated infections

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Well described costs associated with HAI

- Drug (antibiotics) acquisition
- Increased hospital stay

Wilcox MH, et al. *J Hosp Infect* 2000;45:81-4 11

Poorly described costs associated with HAI

- Control measures (isolation facilities, committees, policies)
- Impaired hospital activity (ward closing, etc.)
- Confidence, performance of staff
- Litigation
- Effects on community
- Morbidity
- Mortality

Wilcox MH, et al. *J Hosp Infect* 2000;45:81-4 12

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Excess costs of HAI (Adults)-(US Dollars)			
Study	Year	Country	Cost (\$)
<i>Westwood JCN</i>	1974	USA	1,650
<i>Haley RW</i>	1980	USA	1,018
<i>Coello R</i>	1993	England	1,759
<i>Diaz Molina C</i>	1993	Spain	1,909
<i>Yalcin AN</i>	1997	Turkey	1,582
<i>Orrett FA</i>	1998	Trinidad	1,910
<i>Andersen BM</i>	1998	Norway	2,200
<i>Esatoglu AZ</i>	2001	Turkey	2,298
<i>Chen YY</i>	2003	Taiwan	3,306

Yalcin AN. *Indian J Med Sci* 2003;57:450-6 13

Excess costs of HAI (Pediatrics)-(US Dollars)			
Study	Year	Country	Cost (\$)
<i>Leroyer A</i>	1997	France	10,440
<i>Navarette D</i>	1999	Mexico	11,682
<i>Mahieu LM</i>	2001	Belgium	12,399

Yalcin AN. *Indian J Med Sci* 2003;57:450-6 14

- Studies on excess costs in healthcare-associated infections**
- Surgical site infections
 - Bloodstream infections
 - Catheter-related bloodstream infections
 - Pneumonias
 - Ventilator-associated pneumonias
- 15

- Surgical site infections**
- Songklanagarind Hospital, Chiang Mai University, Thailand, 1998-2003
 - 140 matched pairs of case and control
 - Procedures: Appendectomy, herniorrhaphy, mastectomy, cholecystectomy, colostomy and craniotomy
 - Mean extra hospital charge.....43,658 Baht (95 % C.I.; 30,228-57,088 Baht) (p< 0.001)
 - Mean excess postoperative stay.....21,3 days (95 % C.I.; 16,6-26,0 days) (p< 0.001)
- Kasatpibal N, et al. *J Med Assoc Thai* 2005;88:1083-91 16

- Surgical site infections**
- Tikur Anbessa Hospital, Adid Ababa, Ethiopia, 1999
 - 1754 surgical patients and controls
 - Infection rate: 14,8%
 - Mean excess postoperative stay.....19,6 days (cases) 11,3 days (controls)
 - Mortality rates: 10,8% (cases).....3,9 % (controls)
- Taye M. *Ethiop Med* 2005;43:167-74 17

- Healthcare-associated bloodstream infections (Neonatal-ICU)**
- University Hospital of Blida, Zabana, Blida, Algeria, 2004-7
 - 83 neonates and 166 controls
 - Excess hospitalization: 9,2 days
 - Excess cost: \$ 1,315 (\$ 2,584 vs \$ 1,269)
- Atif ML, et al. *Infect Control Hosp Epidemiol* 2008;29:1066-70 18

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Healthcare-associated bloodstream infections (ICU)

- Dr BL Kapur Memorial Hospital, New Delhi, India, 2006
- 24 patients and 48 controls
- Excess hospitalization: 11,6 days (p< 0.0001)
- Mortality : 54 % (p< 0.0001)
- Excess cost: \$14,818 (10,663 -18,974), (p< 0.0001)

Kothari A, et al. *J Hosp Infect* 2009;71:143-8

Central catheter-related bloodstream infections

- Six ICU, Buenos Aires, Argentina, 1997-2002
- 142 patients, 142 controls
- Excess hospitalization: 11,9 days
- Excess mortality: 24,6 %
- Excess cost: \$4,888
- Excess antibiotics cost: \$1,913

Rosenthal VD, et al. *Am J Infect Control* 2003;31:475-80

Central venous catheter-associated bloodstream infections (ICU)

- General Hospital, Specialties Instituto Mexicano del Seguro Social Hospital, Gabriel Mancera Hospital, Mexico City, Mexico, 2002-3
- 55 patients, 55 controls
- Excess hospitalization: 6,1 days
- Excess mortality: 20%
- Excess cost (mean): \$11,591
- Excess antibiotics cost (mean): \$598

Higuera F, et al. *Infect Control Hosp Epidemiol* 2007;28:31-5

Healthcare-associated pneumonias

- Six ICU, Buenos Aires, Argentina, 2001-2005
- 307 n. pneumonias, 307 controls
- Excess cost → \$ 2,255
- Excess antibiotic cost → \$ 996
- Extra length of stay → 8,95 days
- Extra mortality → 30,3 %

Rosenthal D, et al. *Am J Infect Control* 2005;33:157-61

Ventilator-associated pneumonias

Study (period)	Country	Number VAP/ Control	Cost VAP (\$)	Cost Control (\$)	p
Hugonnet S (1995-1997)	Switzerland	97/97	24 727	17 438	< 0.001
Warren DK (1998-1999)	USA	127/692	70 568	21 620	< 0.001
Cocanour CS (2002-2003)	USA	70/70	82 195	25 037	< 0.05
Karaoglan H (2004-2005)	Turkey (Antalya)	81/81	8 602	2 621	< 0.0001
Kollef MA (2008-2009)	USA	2144/2144	133 371	74 729	< 0.0001

Costs of HAI (ICU)

- Mexico City, Mexico, 1998

	Cases (n: 43)	Controls (n: 86)	p
LOS in ICU	16,3 days	10,8 days	0.001
Daily cost in ICU	\$ 3,715	\$ 1,935	0.001

Sanchez-Velazquez LD, et al. *Arch Med Res* 2006; 37: 370-5

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Attributable costs of HAI (US \$)

Infection type	Attributable costs (Mean)	Range (Minimum-maximum)
Surgical site infection	17,944	7,874-26,668
Bloodstream infection	18,432	3,592-34,410
Ventilator-associated pneumonia	22,875	9,986-54,503
Urinary tract infection	1,257	804-1,710

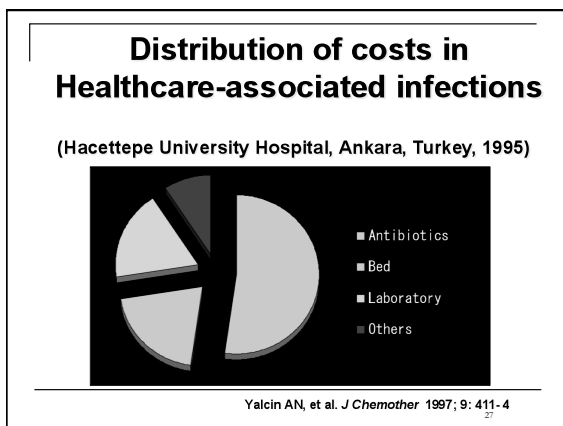
Yokoe DS, et al. *Infect Control Hosp Epidemiol* 2008; 29 (Suppl. 1):S3-S11 25

Costs of Healthcare-associated infections

(Hacettepe University Hospital, Ankara, Turkey, 1995)

	HAI	Control
■ Bed	464	214
■ Laboratory	417	249
■ Antibiotics	1190	54
■ Others	209	181
■ TOTAL	\$ 2280	\$ 698

Yalcin AN, et al. *J Chemother* 1997;9:411-4 26



Distribution of cost (VAP)(\$)

(Akdeniz University Hospital, Antalya, Turkey, 2006-7)

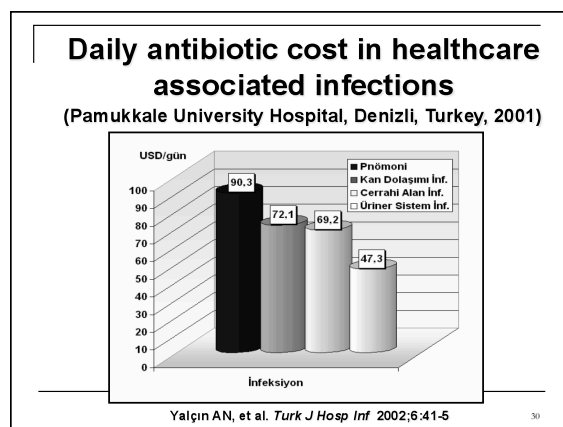
Costs	Costs of VAP Group ± SD (min-max)	Costs of Control Group ± SD (min-max)	P value
Bed	1193.7±679.8 (176-3140)	381.0±382.2 (154-3320)	<0.0001
Antibiotics	837.1±472.9 (40-2140)	8.5±11.0 (0-40)	<0.0001
Drugs and medical materials	2305.0±1347.6 (330-8143)	816.7±645.9 (125-4125)	<0.0001
Laboratory	1647.0±1004.5 (248-9058)	546.4±442.4 (34-2335)	<0.0001
Radiology	269.9±222.1 (36-1683)	156.8±160.9 (16-806)	<0.0001
Operation	628.2±1190.1 (0-7280)	302.4±535.3 (0-2523)	<0.05
Intervention	1024.6±973.8 (135-7794)	254.3±271.7 (43-1579)	<0.0001
Care	696.7±613.1 (72-3753)	155.4±192.8 (23-1524)	<0.0001
Total	8602.7±5045.5	2621.9±2053.3	<0.0001

Karaođlan H, Yalcin AN, et al. *Infez Med* 2010;18:248-55 28

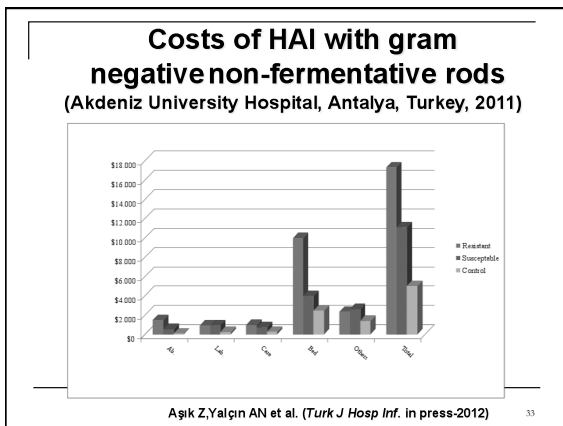
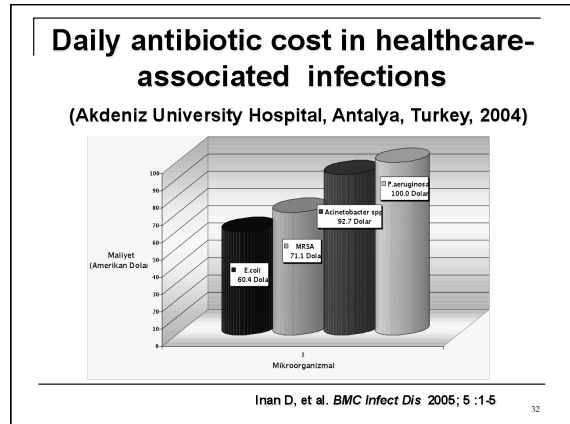
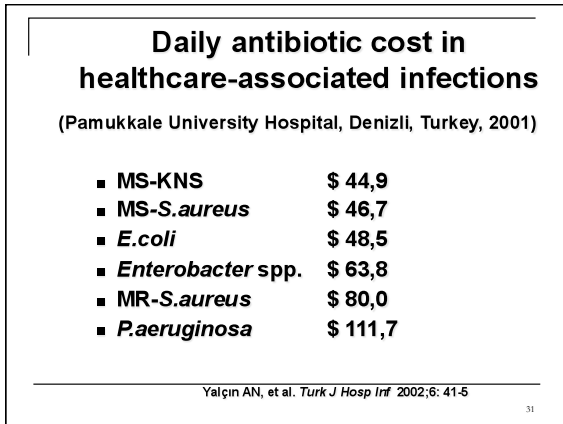
Daily antibiotic cost in healthcare-associated infections

■ Urinary tract infections	96-203 FF
■ Pnemonias	108-219 FF
■ Surgical site infections	116-220 FF
■ Bloodstream infections	165-287 FF

Astagneau P, et al. *J Hosp Infect* 1999;42:303-12 29



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Excess length of stay in healthcare-associated infections

Study	Year	Country	LOS (days)
<i>Westwood JCN</i>	1974	USA	22,0
<i>Haley RW</i>	1980	USA	13,4
<i>French GL</i>	1991	Hong Kong	23,4
<i>Yalcin AN</i>	1997	Turkey	20,3
<i>Orrett FA</i>	1998	Trinidad	33,5
<i>Sanou J</i>	1999	Burkina Faso	10,0
<i>Esatoglu AZ</i>	2001	Turkey	25,0
<i>Askarian M</i>	2003	Iran	6,2
<i>Sanchez-V LD</i>	2006	Mexico	10,0

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Excess length of stay in healthcare-associated infections

Infection type	Excess length of stay (days)
Urinary tract infection	1-4
Surgical site infection	7-8,2
Bloodstream infection	7-21
Pneumonias	6,8-30

Jarvis WR. *Infect Control Hosp Epidemiol* 1996;17: 552-7 35

Excess length of stay in HAI (days)

	UTI	VAP	CR-BSI
Argentina	7.9	8.7	9.3
Brasil	8.9	9.1	7.8
Mexico	5.9	10.7	7.1
Turkey	8.7	8.3	9.5
India	4.2	5.4	2.0

INICC Project (ICACC-2005) posters :K-1916, K-1920, K-1922, K-1923, K-1924 36

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Extra mortality in healthcare-associated infections (%)			
Study	Year	Country	Mortality rate
<i>Spengler RF</i>	1978	USA	32,1
<i>French GL</i>	1991	Hong Kong	7,4
<i>Dinkel RH</i>	1994	USA	4,1
<i>Yalcin AN</i>	1997	Turkey	16,7
<i>Martin M</i>	2001	Spain	21,3
<i>Sanchez-V LD</i>	2006	Mexico	16,3

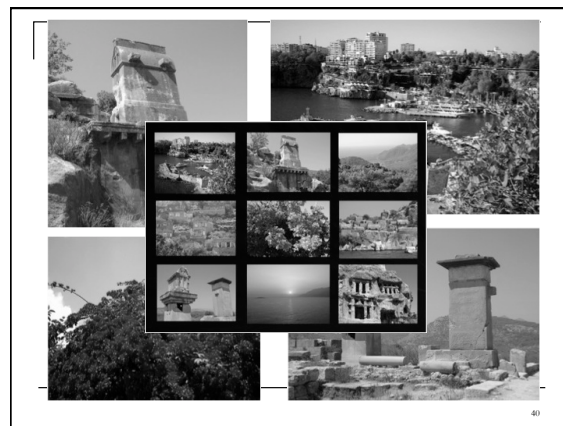
Economical analysis studies in Healthcare-associated infections

- Use of guidelines for authors and editors on conducting an economic analysis,
- Continued development of more sophisticated mathematical models,
- Training of infection control professionals in economic methods

Stone PW, et al. *Am J Infect Control* 2005; 33:501-9

Thanks.....

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