



Prevention and Control of nosocomial CDAD

Ten helpful approaches to prevent,
manage and control CDAD

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Problem to be discussed:

Increase in frequency and severity
(lethal outcome) of CDAD, the most
common cause of nosocomial
diarrhea

Spread of certain epidemic strains
(e.g. BI/NAP1/027 with resistance to
fluoroquinolones)



International and national sources of information

- ECDC: Emergence of *C. difficile*-associated diseases in Canada, the United States of America and Europe (Background document Kuijper et al. 2007)
- National *C. difficile* Standards Group: Report to the Department of Health (UK). *J. Hosp. Inf.* 56:1-38 (2004)
- Implications of the changing face of *C. difficile* disease for health care practitioners. McFarland et al. *AJIC* 35:237-253 (2007)
- Robert Koch-Institut: www.rki.de Infektionsschutz > Krankenhaushygiene > Informationen zu ausgewählten Erregern/*C. difficile*; *Epidemiological Bulletin* September 36/2006
- NRZ für die Surveillance nosokomialer Infektionen: www.nrz-hygiene.de
- Schneider et al. *D. Ärzteblatt* 22:B 1403 (2007); AWMF-Guideline



Population at risk for CDAD

Risk Factors

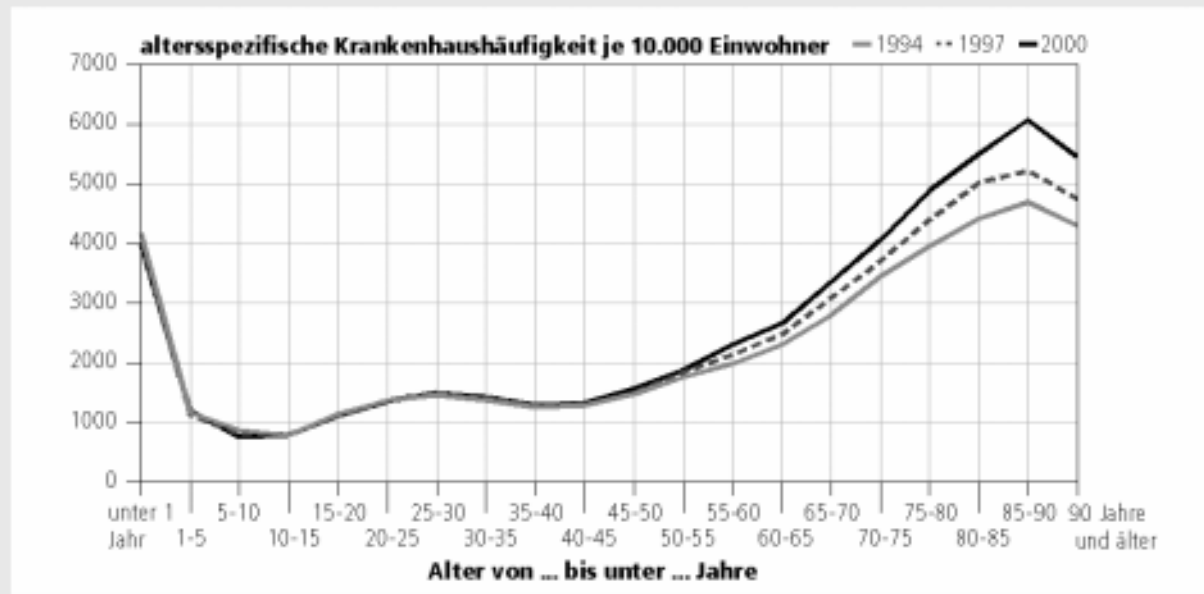
- age
- antimicrobial therapy
within the last 3-6 months
- hospitalisation (> 3 d)
- abdominal surgery
- bowel disease
- tube feeding
- chemotherapy



Public health impact: The population at risk is increasing in number!

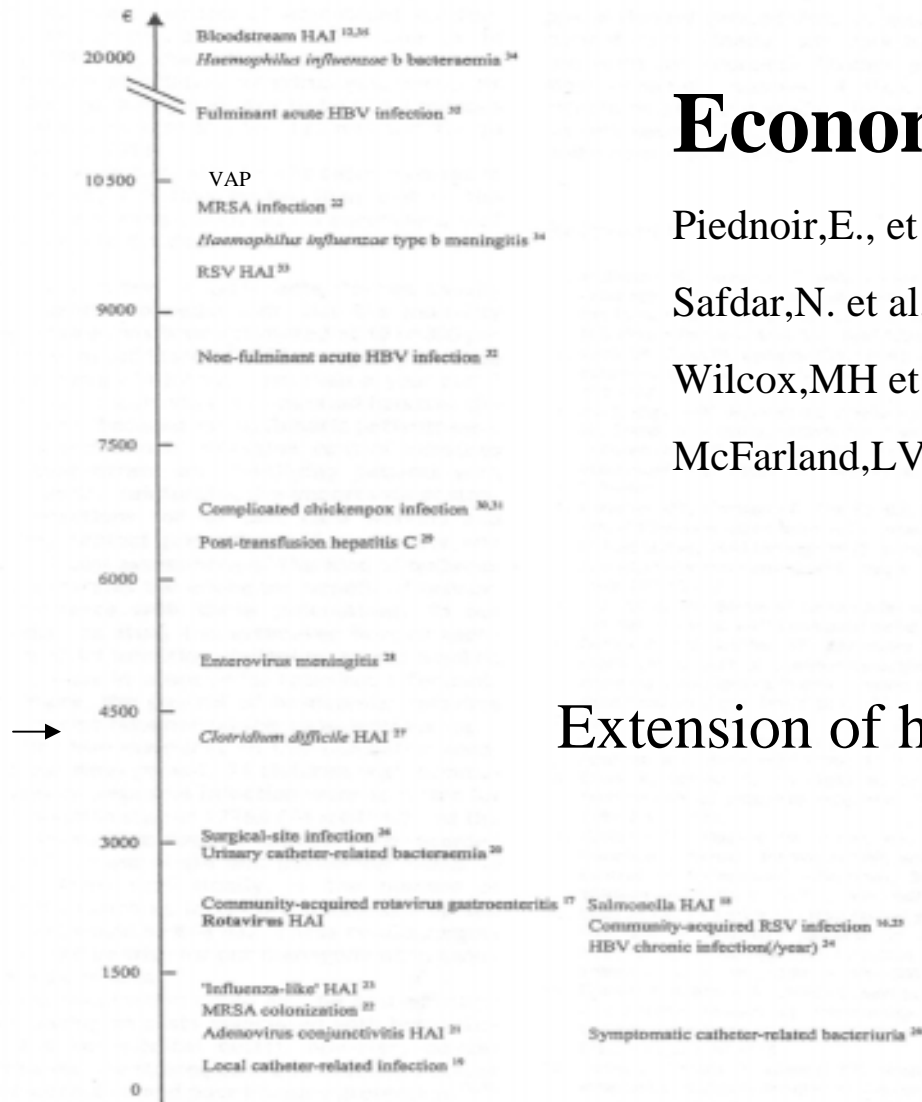
Abbildung 18-3

Aus dem Krankenhaus entlassene vollstationäre Patientinnen und Patienten* Vergleich der Altersstruktur 1994, 1997 und 2000**



* ohne Stundenfälle

** Ergebnisse der Auswertung einer 10-prozentigen Stichprobe



Economical impact

Piednoir,E., et al. (2003) JHospInf.

Safdar,N. et al. (2005) CritCareMed

Wilcox,MH et al. (1996) JHospInf.

McFarland,LV et al. (2006) AJIC

Extension of hospital stay: 4-14d

Figure 1 Cost of healthcare-associated and community-hospitalized infection ((€/case). HBV, hepatitis B virus; MRSA, methicillin-resistant *Staphylococcus aureus*; RSV, respiratory syncytial virus.



The ten cornerstones of prevention and control of severe nosocomial infections with epidemic potential

Common (VRE, ESBL-producing E.coli/Klebsiella; MRSA) and C. difficile-specific preventive measure



Prevention (of *C. difficile*) infection relies on preventing as far as possible patient's exposure to the organism, and ensuring that they do not become susceptible through disruption of their normal gut flora.



Common preventive measures

- 1) High quality of **standard hygienic measures** including careful cleaning of the patient's environment
- 2) **Rational/Restrictive use of antibiotics; antibiotic stewardship; Prescriber education**
- 3) Availability of isolation capacity/ Clear **isolation strategies**/Outbreak management/Availability of practice guidelines



Disruption of the normal colonic flora.

Cave: Broad spectrum antibiotics
including anaerobes; bile excretion !!
e.g. fluoroquinolones

Probiotics may be protective

(D'Souza, AL et al. (2002) BMJ 324.1361-1364)



Characteristics of patients carrying *C. difficile*

(Riggs et al. 2007 CID)

Table 2. Univariate logistic regression analysis of characteristics associated with carriage of *Clostridium difficile* in stool for 68 long-term care patients with no symptoms of *C. difficile*-associated disease (CDAD).

Characteristic	Carriage of <i>C. difficile</i> in stool	
	OR (95% CI)	<i>P</i>
Fecal incontinence	1.73 (0.63–4.67)	.285
Any antibiotic use in the previous 3 months	3.39 (1.24–9.23)	.017
Antianaerobic agents	2.35 (0.76–7.24)	.138
Fluoroquinolones	3.00 (0.99–9.13)	.053
Cephalosporins	1.33 (0.41–4.36)	.634
Proton pump inhibitor use	0.61 (0.23–1.61)	.321
Previous CDAD ^a	20.71 (2.41–8)	<.001

^a The OR was not calculable by logistic regression, because previous CDAD predicts current carriage perfectly; the OR was estimated by 2 × 2 analysis after adding 0.5 to each cell; the lower bound of 95% CI was estimated by Cornfield approximation.



Specific preventive measures

- 4) **Clinical Awareness**

Early recognition of (inflammatory) diarrhoea or toxic megacolon

- 5) Availability of **standardized diagnostic strategies** and indications for microbiological tests (e.g. 3 unformed stools/d, age > 65, fever or leukocytosis)
Use of immunoassays, detecting both toxin A and B
(DD: *C. perfringens*; *S. aureus*; Norovirus)



Therapy and isolation strategies

- 6) **Prompt treatment** (Metronidazol; Vancomycin; Zar et al. 2007; CID 45:302-7) and **isolation**



Physical proximity to a symptomatic case is a risk factor for transmission.

McFarland et al. (1989) NEJM 320:204-10; Chang, VT; Nelson, K. (2000) CID 31:717-22



Role of the environment?

Problem: *C. difficile* is an aero-tolerant
sporeforming bacillus



Some facts I

- Patients shed vegetative cells and spores
- Rates of colonisation increase with age (> 65!) and length of hospitalisation and are higher during outbreaks
- Mean densities of *C. difficile* in stool:
 - - Patients with CDAD: 5,6 +/- 1,4 log₁₀/g stool
 - - Asymptomatic carriers: 3,6 +/- 1,3 log₁₀/g stool
(Riggs et al. 2007 CID)
 - - Asymptomatic infants (1 month): 3 - 7 log₁₀/g stool
(Kim,K-H et al. (1981) JID143:42-50)



Some facts II

- The patient's environment is contaminated with *C. difficile* (for months (depending on the inoculum); symptomatic > asymptomatic)
- Cross contamination (same room as well as room-to-room is well established)



Percentage of *C. difficile*-positive samples from the environment: symptomatic patients > asymptomatic carriers

CLOSTRIDIUM DIFFICILE COLITIS—FEKETY ET AL.

TABLE I Results of Environmental Cultures

Sites Cultured	Areas With Cases	Areas With No Known Cases
Floors	43/305 (14)*	5/145 (3)*
Bathroom	9/55 (16)	0/10 (0)
Patient's room	21/140 (15)	2/70 (3)
Soiled utility room	12/80 (15)	3/45 (7)
Clean storage room	2/30 (7)	0/20 (0)
Furniture surfaces	3/106 (3)	1/48 (2)
Toilets	17/55 (31)	1/5 (20)
Bedpans, hoppers	16/111 (14)	2/60 (3)
Bedding (in use)	9/75 (12)	3/45 (7)
Bedding (clean)	0/20 (0)	0/8 (0)
Uniforms, gowns	1/51 (2)	0/30 (0)
Scales	8/40 (20)	1/30 (3)
Tubs, sinks, washbasins	7/110 (6)	1/64 (2)
Dust mops, pans	2/6 (33)	0/4 (0)
Shoes	1/4 (25)	1/4 (25)
Stethoscopes, flashlights, sphygmomanometers	2/95 (2)	0/67 (0)
Walls	0/40 (0)	0/20 (0)
Windows	0/28 (0)	0/23 (0)
Plants	0/5 (0)	0/0 (0)
Food, dishes	0/14 (0)	0/24 (0)
Air conditioner filters	0/5 (0)	0/5 (0)
Air (30 cu ft/sample)	0/16 (0)	0/7 (0)
All sites	110/1,086 (10)	15/589 (3)

*Number positive/number of cultures (percent positive).



Consequently: Contact (enteric) Isolation

Gowns



Surface
Disinfection

Daily change
of linen

Waste
Disposal

Medical
Devices
(e.g.
thermometers)



Use of
gloves





Spores and Disinfection

- Surface disinfection: horizontal and hand contact surfaces, bathroom! :
- Peracetic acid-based disinfectants (e.g. at least 0.1% acidic or 0.4% alkaline PAA) or
Sodium hypochlorite (e.g. 1000-3000-5000 ppm depending on clean or dirty conditions as well as unbuffered or buffered preparations; freshly prepared)
- Wash hands (in addition to routine alcoholic hand disinfection) before preparation of food



Assure Epidemiologic Competency

- 7) Establish **standardized surveillance** and feed back strategies (e.g. CDAD-KISS)
- 8) Algorithm for early **cluster/outbreak recognition**
(e.g. 3 or more cases/month in one department > bacterial culture for epidemiological typing and antimicrobial susceptibility testing > reporting; EpiBull September 36/2006)
- 9) Availability of **Expert/Reference Laboratories for strain typing and determination of resistency**



Standardised reporting system

The image shows the cover of a manual for the KISS (Krankenhaus-Infektions-Surveillance-System) reporting system. At the top left is the NRZ logo (Nationales Referenzzentrum für Surveillance von nosokomialen Infektionen) with a map of Germany. At the top right is the Robert Koch Institute logo. The main title is 'Krankenhaus-Infektions-Surveillance-System (KISS)'. Below that is 'CDAD-KISS: Surveillance-Protokoll Clostridium difficile assoziierte Diarrhö in Krankenhäusern'. At the bottom is the website 'Www.nrz-hygiene.de'.

NRZ
Nationales Referenzzentrum
für Surveillance
von nosokomialen Infektionen

ROBERT KOCH INSTITUT

**Krankenhaus-Infektions-
Surveillance-System (KISS)**

**CDAD-KISS:
Surveillance-Protokoll
Clostridium difficile assoziierte
Diarrhö in Krankenhäusern**

Www.nrz-hygiene.de



National Experts Reference/Advisory Laboratories

Prof. Kist (Freiburg)

Prof. von Eichel-Streiber (Mainz)

Prof. Witte (Wernigerode)



- 10) **Information** (education and training)
of patients (hand hygiene), healthcare providers (including nursing homes), antimicrobial drug prescribers



Information

www.rki.de



Thanks for your interest