



# 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](http://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](http://www.nrz-hygiene.de)
- Schneider et al. *D. Ärzteblatt* 22:B 1403 (2007); AWMF-Guideline



# Population at risk for CDAD

## Risk Factors

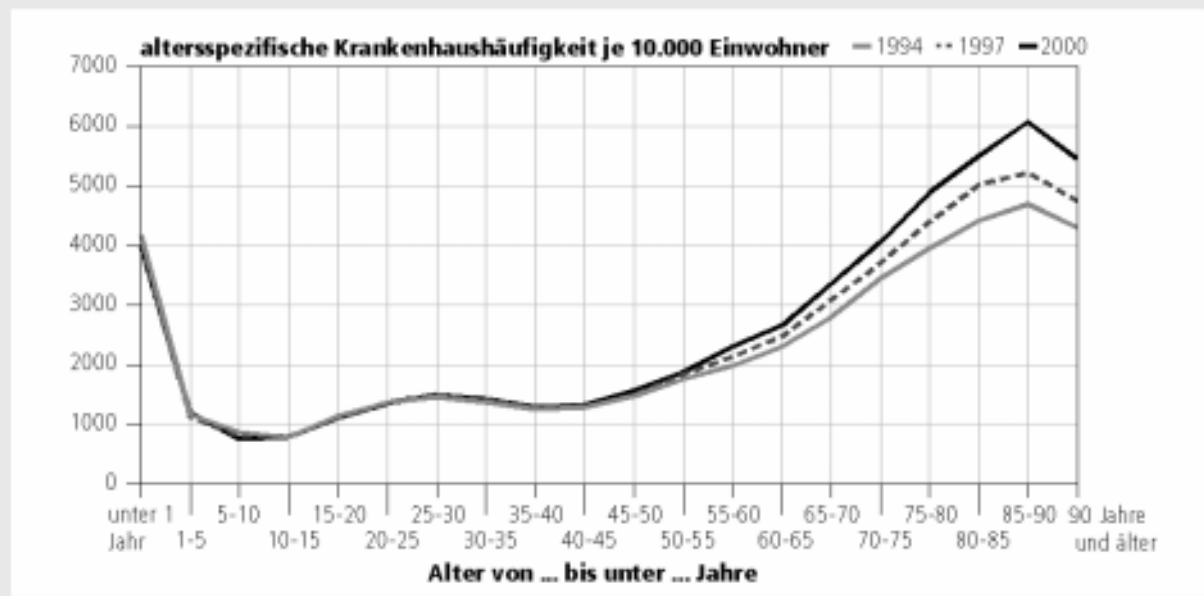
- age
- antimicrobial therapy  
within the last 3-6 months
- hospitalisation (> 3 d)
- abdominal surgery
- bowel disease
- tube feeding
- chemotherapy



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

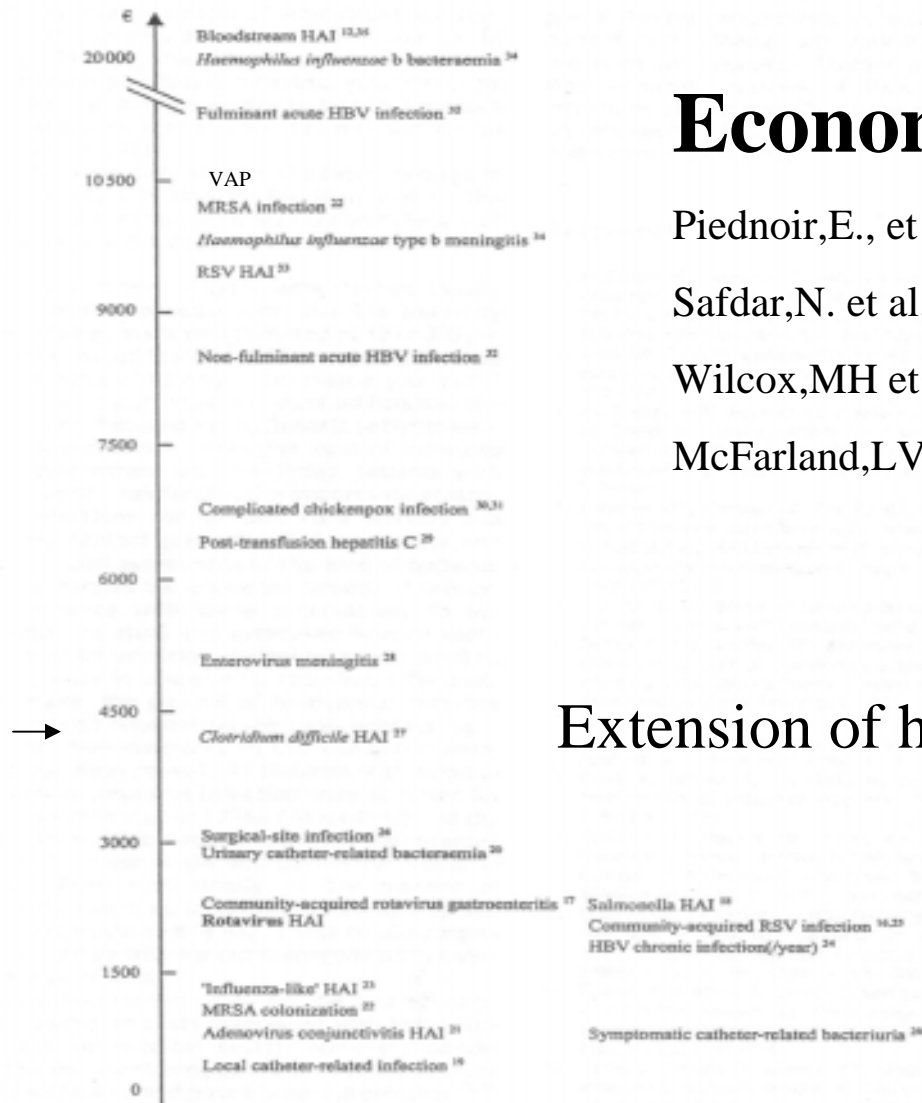
Abbildung 18-3

## 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 <sup>a</sup>	20.71 (2.41–8)	<.001

<sup>a</sup> 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:  $5,6 \pm 1,4 \log_{10}/g$  stool
  - - Asymptomatic carriers:  $3,6 \pm 1,3 \log_{10}/g$  stool  
(Riggs et al. 2007 CID)
  - - Asymptomatic infants (1 month):  $3 - 7 \log_{10}/g$  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 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](http://Www.nrz-hygiene.de)



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# 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

ROBERT KOCH INSTITUT

Das Institut | Gesundheit A-Z | Gesundheitsberichterstattung und Epidemiologie

Infektionsschutz | Infektionserreger A-Z | Forschung | Service

Informationen zu ausgewählten Erregern

Übertragung: Via aerosol aus speichel, über Tröpfchen

- Infotota
- Tuberkulose
- Coronavirus Atypisches (SARS-CoV-2)
- Deltacoronavirus (Deltacoronavirus)
- SARS-CoV-2
- Mumps, Herpes simplex
- Molluscum contagiosum

Übertragung: Via Injektion über Fomiten bzw. Blut o. a. Instrumente

Erreger mit spezieller Resistenz und Multiresistenz

- Methicillin-resistente Staphylococcus aureus (MRSA)
- Vancomycin-resistente Enterokokken (VRE)
- Enterococcus
- Beta-Lactamase-Produzierende Mikroorganismen (BPM)
- S. aureus Enterococcus spp.

Übertragung: Via Injektion über kontaminiertes Wasser

- Legionella spp.
- Pseudomonas spp. / Acinetobacter spp. / Burkholderia spp. / Mycobacter spp.

Übertragung: Via Injektion über Blutinjektionen bzw. Graue Organe



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Thanks for your interest