

艰难梭菌 (CLOSTRIDIUM DIFFICILE) 感染 流行现状、诊治策略与防控要点

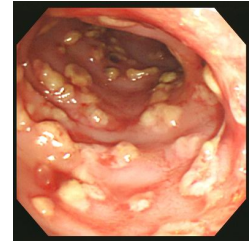
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伪膜性肠炎：病原体？

- 王X, 女, 65Y, 长期血透。2周前不慎跌倒, 右膝血肿, 并发蜂窝组织炎而住院。经头孢唑林治疗好转出院。
- 本次入院前一日, 出现下腹痛伴低热、乏力。T38°C, 下腹部略为膨隆, 有压痛。住院当日出现腹泻, 黏液及血便。
- 结肠镜检: 乙状结肠部份, 肛门以上15至40公分间, 结肠黏膜发红肿胀流血, 伴随许多大大小小的溃疡及黄色的伪膜。病理报告诊断确定为伪膜性肠炎。



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Dr.HU Bijie

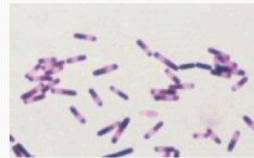
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关于成人感染性腹泻

- 普通粪便培养主要分离沙门菌和志贺菌, 城市人群中已经明显减少;
- 致病性大肠杆菌需要选择培养基;
- 特殊培养以往分离霍乱菌, 很少见但要警惕;
- 社区感染中嗜盐弧菌检出率有明显增加;
- 病毒性腹泻中诺如病毒, 可引起社区和医院感染暴发
- 抗生素相关腹泻主要是艰难梭菌引起, 发病增加, 但检出困难, 多采用经验性治疗, 可暴发, 要隔离

C. difficile – General Microbiology

- Anaerobic;
- Gram-positive or Gram-variable bacilli;
- Spore-forming;
- Produces at least 2 toxins, toxin A and toxin B



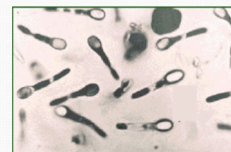
Credit: CDC

艰难梭菌 (Clostridium difficile, CD)

- 艰难梭菌 (Clostridium difficile, CD) 是一种专性厌氧的革兰染色阳性、产芽胞的杆菌, 广泛分布于自然界环境、人类和动物的粪便中, 由Hall和O Toole于1935年首次报道, 但直到1978年, 人们将产毒素的CD的检出与伪膜性结肠炎 (PMC) 相关联才被重视。
- 有报道认为, 临床上90%-100%的PMC是由CD引起的。

C. difficile - Spores

- Spores represent a survival strategy
- Resistant to heat, drying, pressure, and disinfectants
 - Promotes bacterial survival in harsh environments, e.g., hospital environments
- Resistant to many antibiotics



感控的重要任务：遏制MDRO蔓延，

- **MRSA** 甲氧西林耐药金葡菌
- **VRE** 耐万古霉素肠球菌
- **MDR-PA** 多重耐药铜绿假单胞菌
- 产**ESBL**菌 → MDR肠杆菌科细菌
- **CRE** 碳青霉烯类耐药肠杆菌科细菌
- **PDR-AB** 碳青霉烯类耐药不动杆菌
- **C. difficile** 艰难梭菌

Confusing terminology

- Antibiotic-associated diarrhea(AAD)
 - C. difficile is only one cause
- *Clostridium difficile*-associated diarrhea(CDAD)
 - diarrhea + positive stool test
- *Clostridium difficile* colitis(CDC)
 - underlying pathologic process
- Pseudomembranous colitis(PMC)
 - endoscopic demonstration of exudative lesions
- Toxic megacolon
 - radiologic and surgical diagnosis

Clostridium Difficile-Associated Disease

C. difficile - Epidemiology

- Normal fecal flora of newborns
- Detected in 2% of healthy adults
- 10-20% of elderly individuals colonized
- 20-40% of hospitalized patients colonized
- Isolated from toilets, bedpans, floors
- Accounts for 15%-25% of all antibiotic-associated diarrheal episodes

CD是人类肠道的正常菌群？

- CD是人类肠道的正常菌群，~3%人群肠道中可以检出。
- 不合理使用抗生素、免疫抑制剂、质子泵抑制剂或化疗药物，以及胃肠切除手术等诸多因素，均可导致人体正常肠道菌群平衡失调，致使该菌的过度繁殖，引发艰难梭菌相关性腹泻（*Clostridium difficile* associated diarrhea, CDAD）。
- 导致人类腹泻的主要机制与该菌产生A/B毒素有关，大多数CD产毒株同时产生A/B两种毒素，编码基因*tcdA*和*tcdB*存在于该菌致病性决定区（Pathogenicity Locus, PaLoc）中
- 近十年来，临床中出现了仅产毒素B的菌株，即由A⁻B⁺菌株所致的严重的临床症状，并不时出现人群感染暴发而受到人们对CD菌株的不断变异与临床特征相关联的研究。

艰难梭菌感染

- 艰难梭菌感染（*Clostridium difficile* infection, CDI）患者的临床表现为非特异性的，轻者表现为自限性腹泻，重者则表现出PMC和中毒性巨结肠。
- 近年来在北美和欧洲一些国家出现高产毒素的CD菌株，最具代表性的是O27/NAP1/B1株，即**PCR-核糖体分型027**，脉冲场凝胶电泳分型NAP1，限制性内切酶分型BI^[7-8]。
- 该高产毒素的CD菌株所引发的CDAD的临床表现、耐药谱、病死率、复发率均明显高于其它型别的菌株；并时常引发医院内感染暴发。

CDI已成为公共卫生问题？

- 美国2000-2005年CDI发病率从5.5/万增至11.2/万，病死率从2000年的1.2%增至2004年的2.2%。
- 奥地利2006年报告的CD病例数与2003年相比，增加了2.8倍。
- 新加坡CDI的发病率从2001年的1.49/万升至2006年的6.64/万，检出毒素阳性菌株的比例从7%升至11%。
- 韩国的产毒素的CD检出率也从2002年的7%上升至2004年的50.3%。

美国每年因艰难梭菌感染导致 15,000至20,000人死亡！

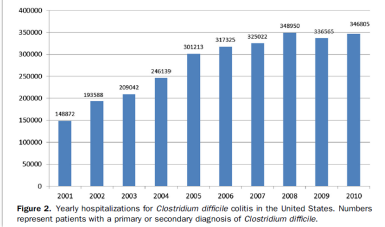


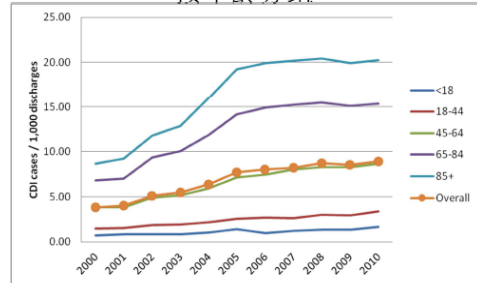
Figure 2. Yearly hospitalizations for Clostridium difficile colitis in the United States. Numbers represent patients with a primary or secondary diagnosis of Clostridium difficile.

图2. 美国艰难梭菌结肠炎患者住院情况。数字代表原发性或继发性艰难梭菌的患者数。

— Clostridium Difficile Colitis in the United States: A Decade of Trends, Outcomes, Risk Factors for Colectomy, and Mortality after Colectomy. J Am Coll Surg (2013), 217:802-812.

- 定植5%健康成人, 30-70%婴儿。
- 25 - 30%抗生素相关腹泻。
- 2006-2010年艰难梭菌结肠炎发生率增加**47%**。

美国每千人出院病人CDI发病数： 按年龄分组



CDAD Rates and Mortality Increase in Parallel with Patient Age

Age (Years)	CDAD Rate per 1000 Admissions	Attributable 30-Day Mortality Rate (%)
<40	3.5	2.6
41-50	11.2	1.2
51-60	20.0	3.2
61-70	24.4	5.1
71-80	38.3	6.2
81-90	54.5	10.2
>90	74.4	14.0

Loo et al NEJM 2005;353:2442-9

流行病学和疾病负担

近年来CDI死亡率明显增加

- 加拿大魁北克2004年CDI 30天归因死亡率达6.9%，较1997的1.5%增加了4倍

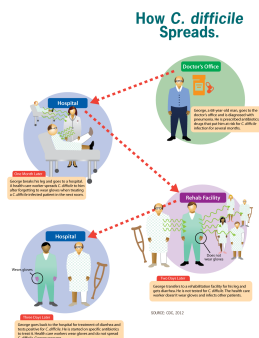
N Engl J Med 2005;353:2442-2449.
Infect Control Hosp Epidemiol 2002;23:137-140.

- 美国因CDI导致的死亡数从1997到2008年增加了10倍。92%的CDI所致死亡见于≥65岁的人群

National Vital Statistics Report. Available at: http://www.cdc.gov/nchs/data/nvsr/nvsr59/nvsr59_04.pdf.

CD的传播

- 传染源：患者、携带者、环境污染
- 传播途径：接触传播（粪口传播）
- 易感人群：免疫受限、高龄、长时间使用广谱抗菌药物者



高危因素

不可控因素

- 年龄>64岁（最主要危险因素）

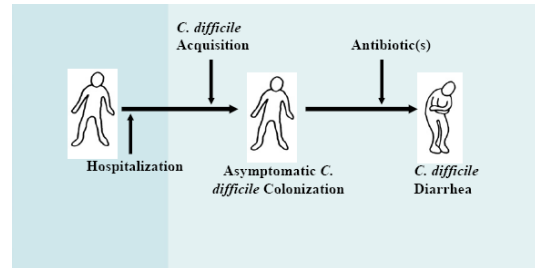
可能可控因素

- 抗菌药物（任何抗菌药都可致CDI，常见：喹诺酮、头孢和克林；联用、长期用 Clin Infect Dis 2008;46 S1:S19-31.
- 抗肿瘤化疗
- 抑酸剂（有争议）
- 住院时间
- 其他

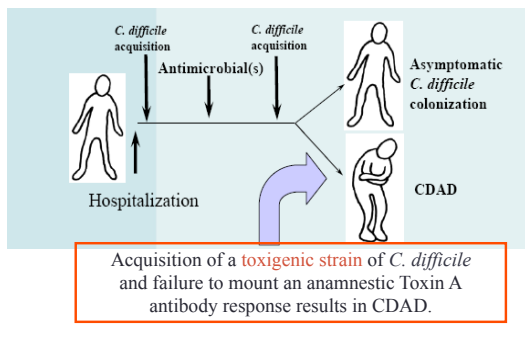
C. difficile - Antibiotics

High Risk	Medium Risk	Low Risk
Cephalosporins	Macrolides	Aminoglycosides
Clindamycin	Co-trimoxazole	Metronidazole
Ampicillin/ amoxycillin	Tetracyclines	Anti-pseudomonal penicillins
Fluoroquinolones		Rifampicin
		Vancomycin

Original (Incorrect) Hypothesis for C. difficile Hospital Infection

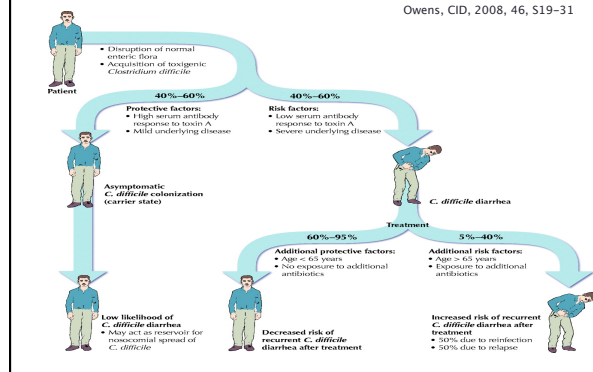


Revised Hypothesis for CDAD



Pathogenesis of CDAD

Owens, CID, 2008, 46, S19-31



C. difficile – Infection (CDI) Outcomes

- Excretion
- Asymptomatic colonization of gut
- Diarrhea
- Colitis
- Pseudomembranous colitis
- Ileus
- Toxic megacolon
- Sepsis
- Death

Clinical Presentation 临床表现

- Asymptomatic colonization
- Mild disease
 - Non-bloody diarrhea
 - Mild abdominal tenderness
- Severe disease
 - Pseudomembranous colitis
 - Paralytic ileus
 - Ileitis
 - Toxic megacolon
 - Ulcerative colitis
 - Perforation(peritonitis)
 - Ascites

艰难梭菌感染的诊断方法，临床价值？

试验方法		敏感性	特异性
纤维镜观察伪膜		+	+++++
病原检测	细菌培养	+++++	+++
	乳胶试验	++	+++
	免疫测试卡	+++	+++
	PCR	?	?
毒力测试	细胞毒力测试	++++	+++++
	EIA测毒素A/B	+++	+++++

Testing Methods

- *C. difficile* products :
 - Toxins A and/or B
 - Glutamate dehydrogenase (GDH),
- Cell culture cytotoxicity assay (CCCA)
- Culture methods for the detection of toxin-producing *C. difficile* [toxigenic culture (TC)]
- Tests for *C. difficile* genes using PCR targets:
 - 16S RNA
 - Toxin genes
 - Genes for GDH



Leukocytosis and CDAD – Do Not Miss this Clue to Possible Fulminant Disease

- Toxin A is a potent neutrophil chemoattractant
- CDAD found
 - in 16% of patients with WBC > 15,000/mm³
 - 25% of patients with WBC > 30,000/mm³.

Clin Infect Dis 2002;34:1585-92
- 58% of 60 patients with unexplained WBC > 15,000/mm³ had CD toxin in stool.

AJM 2003;115:543-6

CDAD Case Definition

- Stool characteristic
 - Diarrhea (most common)
 - No diarrhea
 - Associated with toxic megacolon or ileitis
 - Documented by radiology
- ≥ 1 of the following
 - Stool positive for:
 - *C. difficile* toxin
 - *C. difficile* determined to be a toxin producer
 - Pseudomembranous colitis by:
 - Endoscopy
 - Histological exam

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CD的治疗

- 一般治疗
 - 停用原有抗生素、消除危险因素
 - 水电解质平衡
 - 对症处理：禁用解痉剂
- 抗菌治疗
 - 甲硝唑
 - 万古霉素
 - 非达霉素 (fidaxomicin) ?
 - 利福昔明?
 - 替考拉宁?
- 其他治疗
 - 益生菌：活菌制剂，酵母?
 - 静脉丙种球蛋白?
 - 高分子吸附剂?
 - 粪便移植
- 外科治疗

Treatment of CDAD - General principles

- Whenever possible **withdraw** the offending antibiotic
- Use **oral antimicrobials** whenever possible
- **Be patient**
 - some improvement seen in first 2 days but mean time until resolution of diarrhea is 2-4 days. Don't call them nonresponders until 6 days of therapy
- Treat for **10-14 days**
- **Avoid** antiperistaltic agents

Relapsed Disease

- Due to spores that germinate in gut after withdrawal of the antibiotic
- Happens in 20+ % of patients who initially respond. Increased risk in
 - Age > 65
 - Increased severity of underlying disease
 - Exposure to additional antibiotics after treatment
 - Low serum IgG response to toxin A
- Half of relapses are actually re-infections
- Antibiotic resistance unlikely
- Most patients will respond to a second course of the same antimicrobial

Management of recurrent CDI (RCDI)

- 19. The first recurrence of CDI can be treated with the same regimen that was used for the initial episode. If severe, however vancomycin should be used. The second recurrence should be treated with a pulsed vancomycin regimen. (Conditional recommendation, low-quality evidence)
- 20. If there is a third recurrence after a pulsed vancomycin regimen, fecal microbiota transplant (FMT) should be considered. (Conditional recommendation, moderate-quality evidence)
- 21. There is limited evidence for the use of adjunct probiotics to decrease recurrences in patients with RCDI. (Moderate recommendation, moderate-quality evidence)
- 22. No effective immunotherapy is currently available. Intravenous immune globulin (IVIG) does not have a role as sole therapy in treatment of RCDI. However, it may be helpful in patients with hypogammaglobulinemia. (Strong recommendation, low-quality evidence)

Am J Gastroenterol 2013; 108:478-498;

控制CD播散的措施

- 早期诊断
- CDAD监测案例
- 职业教育
- 适当的隔离措施
- 手卫生
- 防护服装
- 环境卫生和消毒医疗设备
- 合理应用抗菌药物
- CDAD爆发时感控策略

2013 APIC—Guide to Preventing Clostridium difficile Infection

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预防CD水平传播的感染控制措施

措施	推荐强度
手卫生	A-II
接触隔离	
手套	A-I
隔离衣	B-III
单人间或类聚	C-III
环境清洁、消毒或使用一次性物品	
病人房间和环境表面的消毒	B-II
患者使用后的医疗设备	C-III
弃用肛表	B-II
[78]	
使用次氯酸钠（1000 ppm 有效氯）消毒剂	B-II

CDAD prevention and control

- Hand hygiene
 - Personal protective equipment (PPE)
 - Environmental cleaning
 - Use of care equipment
- Hand washing with soap and water or chlorhexidine recommended
- Alcohol-based hand rubs are not effective in removing *C. difficile* spores from hands, not be the only hand hygiene measure when caring CDAD patients
- Patients and visitors strongly encouraged to wash their hands with soap and water, especially before eating and after using the toilet

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Infection Control and Prevention

- 30. A hospital-based infection control programs can help to decrease the incidence of CDI.
- 医院感控计划，有助于减低CDI发病率
- 31. Routine screening for *C. difficile* in hospitalized patients without diarrhea is not recommended and asymptomatic carriers should not be treated.
- 不建议对没有腹泻的住院病人，常规筛查艰难梭菌。无症状的携带者，无需治疗
- 32. Antibiotic stewardship is recommended to reduce the risk of CDI.
- 建议实施抗菌药物管理，以降低CDI风险

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- 33. Contact precautions for a patient with CDI should be maintained at a minimum until the resolution of diarrhea.
- 对CDI病人实施接触隔离，直至腹泻停止
- 34. Patients with known or suspected CDI should be placed in a private room or in a room with another patient with documented CDI.
- 对已知或疑似CDI病人，应置单间或与其他CDI病人同室
- 35. Hand hygiene and barrier precautions, including gloves and gowns, should be used by all health-care workers and visitors entering the room of any patient with known or suspected CDI.
- 进入已知或疑似CDI病人房间的所有医务人员和探视者，必须实施手卫生和屏障隔离，包括手套、隔离衣。

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- 36. Single-use disposable equipment should be used for prevention of CDI transmission. Non-disposable medical equipment should be dedicated to the patient's room and other equipment should be thoroughly cleaned after use in a patient with CDI.
- 为预防CDI传播，使用一次性实施。非一次性医疗物品，应病室内专用。其他设备，病人用后必须彻底清洁。
- 37. Disinfection of environmental surfaces is recommended using an Environmental Protective Agency (EPA)-registered disinfectant with *C. difficile*-sporidicidal label claim or 5000 p.p.m. chlorine-containing cleaning agents in areas of potential contamination by *C. difficile*.
- 在艰难梭菌潜在的污染区，使用EPA建议的能杀艰难梭菌芽孢的消毒剂，进行环境表面消毒，或5000PPM的含氯制剂。
- 38. Although there is moderate evidence that two probiotics (*Lactobacillus rhamnosus* GG and *Saccharomyces boulardii*) decrease the incidence of antibiotic associated diarrhea, there is insufficient evidence that probiotics prevent *C. difficile* infection.
- 没有充分的证据表明，益生菌能预防艰难梭菌感染。

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Concordance of recommendations in national European guidelines with IA-ranked recommendations in the ECDC guidance (PROHIBIT study group)

Country (publication year)	No 'test of cure'	Education of staff	Information for visitors	Do not share thermometers (medical devices in general)	Avoid electronic thermometers with disposable sheaths	Stop AB treatment as soon as possible
ECDC (2008)	Rec. (IA) 1a	Rec. (IA) 1a, 2b, 4, 5	Rec. (IA) 1a, 2b, 4, 5	Rec. (IA) 1b, 2b; (pat. specific IB)	Rec. (IA) 1b, 2b	Rec. (IA) 1a
Austria (2007)	Rec. (IA)	Rec. (IA)	Education in outbreaks	Rec. IA (pat. specific IB)	Not explicitly mentioned	Rec. (IA)
Belgium (2008)	Rec. (IA)	Rec. (IA)	Rec.	Rec.	Not explicitly mentioned	Rec.
Denmark (2011)	Rec.	Rec.	Avoid rectal thermometer	Rec.	Not explicitly mentioned	Rec.
Finland (2009)	Rec.	Rec.	Rec.	Rec. (pat. specific)	Not explicitly mentioned	Rec.
France (2010)	Rec.	Rec.	Rec.	Rec. (pat. specific)	Not explicitly mentioned	Rec.
Germany (2009)	Rec.	Rec.	Rec.	Rec. (pat. specific)	Not explicitly mentioned	Rec.
Ireland (2008)	Rec.	Rec.	Rec.	Rec. (pat. specific)	Not explicitly mentioned	Rec.
Italy (2009)	Rec. (IA)	Rec. (IA)	Rec. (IA)	Rec. (IA) (pat. specific)	Rec. (IA)	Rec. (IA)
Latvia (2007)	Rec.	Rec.	Rec.	Rec. (pat. specific)	Not explicitly mentioned	Rec.
Luxembourg (2007)	Rec. (B-III)	Rec. (B-III)	Rec. (B-III)	Rec. (B-III) (pat. specific)	Not explicitly mentioned	Rec.
Malta (SHEA 2008)	Rec. (B-III)	Rec. (B-III)	Rec. (B-III)	Rec. (B-III) (pat. specific)	Not explicitly mentioned	Rec.
Netherlands (2006)	Rec.	Rec.	Rec.	Rec. (pat. specific)	Not explicitly mentioned	Rec.
Sweden (2006)	Rec.	Rec.	Rec.	Rec. (pat. specific)	Not explicitly mentioned	Rec.
Switzerland (1995)	Rec.	Rec.	Rec.	Rec. (pat. specific)	Not explicitly mentioned	Rec.
UK – England (2008)	Rec. (B)	Rec. (B)	Rec. (B)	Rec. (B) (pat. specific)	Not explicitly mentioned	Rec. (B)
UK – Scotland (2009)	Rec. (IA)	Rec. (IA)	Rec. (IA)	Rec. (IA) [single use IB]	Rec. (IA)	Rec. (IA)

ECDC, European Centre for Disease Control and Prevention; PROHIBIT, Prevention of Hospital Infection by Intervention and Training; Rec., recommended; Pat., patient; AB, antibiotic; blank box, no statement identified for this measure.

Strength of recommendation indicated in parentheses. For the ECDC guidance, the strength of recommendation and the quality of underlying evidence are indicated.

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Country (publication year)	Placing of patients	
	Single room isolation	Cohorting
ECDC (2008)	Rec. (IB; 1b, 2b)	Possible (IB; 1b, 4)
Austria (2007)	Rec. (IB)	Possible (IB)
Belgium (2008)	Rec.	Possible
Denmark (2011)	Rec.	Possible
Finland (2009)	Rec.	Possible
France (2010)	Rec.	Possible
Germany (2009)	Rec.	Possible
Ireland (2008)	Rec.	Possible
Italy (2009)	Rec. (IB)	Possible (IB)
Latvia (2007)	Rec.	Possible
Luxembourg (2007)	Rec.	Possible
Malta (SHEA 2008)	Rec. (B-III)	Possible
Netherlands (2006)	Rec.	Possible
Sweden (2006)	Rec. (I)	Possible
Switzerland (1995)	Rec.	Possible
UK – England (2008)	Rec. (B)	Possible
UK – Scotland (2009)	Rec. (IB)	Possible (IB)

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Environmental disinfecting agent	Hand hygiene		Surveillance
	Wearing of gloves	Washing or disinfecting	
Chlorine-based (IB; 2b, 2c, 4)	Rec. (IB; 2a, 2b, 2c)	Washing (IB; 2a, 2b, 2c)	Rec. (IB; 2b, 3b, 4, 5)
Sporicidal (IA)	Rec. (IB)	Disinfecting then washing (IB)	Rec. (IB)
Chlorine-based	Rec.	Washing then disinfecting	Rec. (mandatory)
Chlorine-based	Rec.	Washing then disinfecting	Rec.
Chlorine-based	Rec.	Washing then disinfecting	Rec.
H ₂ O ₂ or chlorine	Rec.	Disinfecting then washing	Rec.
Chlorine-based	Rec.	Only washing	Rec. (mandatory)
Chlorine-based (IB)	Rec. (IB)	Only washing (IB)	Rec. (IB)
Chlorine-based	Rec.	Washing or disinfecting with chlorhexidine	Rec.
Chlorine-based (B-II)	Rec. (A-I)	Only washing (B-III)	Rec. B-III
Not specified	Rec.	Only washing	Rec.
Peracetic acid	Rec.	Washing then disinfecting (I)	Rec.
Mechanics of cleaning more important	Rec.	Disinfecting or washing with antiseptic soap	Rec.
Chlorine-based (B)	Rec. (B)	Washing then disinfecting (B)	Rec. (B) (mandatory)
Chlorine-based (IB)	Rec. (IB)	Only washing (IB)	Rec. (IB) (mandatory)

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C. difficile – Antibiotic Risk

<p>High Risk Antibiotics:</p> <ul style="list-style-type: none"> Cefotaxime Ceftriaxone Cefalexin Cefuroxime Ceftazidime Ciprofloxacin Moxifloxacin Clindamycin (low dose) 	<p>Medium Risk Antibiotics:</p> <ul style="list-style-type: none"> Meropenem Ertapenem Clindamycin (high dose) Co-amoxiclav Tazocin Erythromycin Clarithromycin
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C. difficile – Antibiotic Risk

Low Risk Antibiotics:

Benzyl penicillin	Gentamicin
Amoxicillin	Metronidazole
Flucloxacillin	Vancomycin
Tetracyclines	Teicoplanin
Trimethoprim	Synercid
Nitrofurantoin	Linezolid
Fusidic acid	Tigecycline
Rifampicin	Daptomycin

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Concordance of recommendations in national European guidelines for a selection of measures (PROHIBIT study group)

Country (publication year)	Placing of patients		Environmental disinfecting agent ¹	Hand hygiene		Surveillance
	Single room isolation	Cohorting		Wearing of gloves	Washing or disinfecting	
ECDC (2008)	Rec. (IB; 1b, 2b)	Possible (IB; 1b, 4)	Chlorine-based (IB; 2b, 2c, 4)	Rec. (IB; 2a, 2b, 2c)	Washing (IB; 2a, 2b, 2c)	Rec. (IB; 2b, 3b, 4, 5)
Austria (2007)	Rec. (IB)	Possible (IB)	Sporicidal (IA)	Rec. (IB)	Disinfecting then washing (IB)	Rec. (IB)
Belgium (2008)	Rec.	Possible	Chlorine-based	Rec.	Washing then disinfecting	Rec. (mandatory)
Denmark (2011)	Rec.	Possible	Chlorine-based	Rec.	Washing then disinfecting	Rec.
Finland (2009)	Rec.	Possible	Chlorine-based	Rec.	Washing then disinfecting	Rec.
France (2010)	Rec.	Possible	Chlorine-based	Rec.	Washing then disinfecting	Rec.
Germany (2009)	Rec.	Possible	H ₂ O ₂ or chlorine	Rec.	Disinfecting then washing	Rec.
Ireland (2008)	Rec.	Possible	Chlorine-based	Rec.	Only washing	Rec. (mandatory)
Italy (2009)	Rec. (IB)	Possible (IB)	Chlorine-based (IB)	Rec. (IB)	Only washing (IB)	Rec. (IB)
Latvia (2007)	Rec.	Possible	Chlorine-based	Rec.	Washing or disinfecting with chlorhexidine	Rec.
Luxembourg (2007)	Rec. (B-III)	Possible	Chlorine-based	Rec.	Only washing	Rec.
Malta (SHEA 2008)	Rec. (B-III)	Possible	Chlorine-based (B-II)	Rec. (A-I)	Only washing (B-III)	Rec. B-III
Netherlands (2006)	Rec.	Possible	Not specified	Rec.	Only washing	Rec.
Sweden (2006)	Rec. (I)	Possible	Peracetic acid	Rec.	Washing then disinfecting (I)	Rec.
Switzerland (1995)	Rec.	Possible	Mechanics of cleaning more important	Rec.	Disinfecting or washing with antiseptic soap	Rec.
UK – England (2008)	Rec. (B)	Possible	Chlorine-based (B)	Rec. (B)	Washing then disinfecting (B)	Rec. (B) (mandatory)
UK – Scotland (2009)	Rec. (B)	Possible (B)	Chlorine-based (B)	Rec. (B)	Only washing (B)	Rec. (B) (mandatory)

PROHIBIT, Prevention of Hospital Infection by Intervention and Training; ECDC, European Centre for Disease Control and Prevention; SHEA, Society for Healthcare Epidemiology of America; Rec., recommended; blank box, no statement identified for this measure.
Strength of recommendation indicated in parentheses. For the ECDC guidance, the strength of recommendation and the quality of underlying evidence are indicated.