Programma del Corso di Farmacologia
Corso integrato di Medicina Interna

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- Terapia delle infezioni gastrointestinali ……4 ottobre 2021
- Terapia farmacologica dell'ulcera peptica……11 ottobre 2021
- Terapia farmacologica del dolore……18 ottobre 2021
- Terapia della gotta……25 ottobre 2021
- I farmaci biologici……..8 novembre 2020

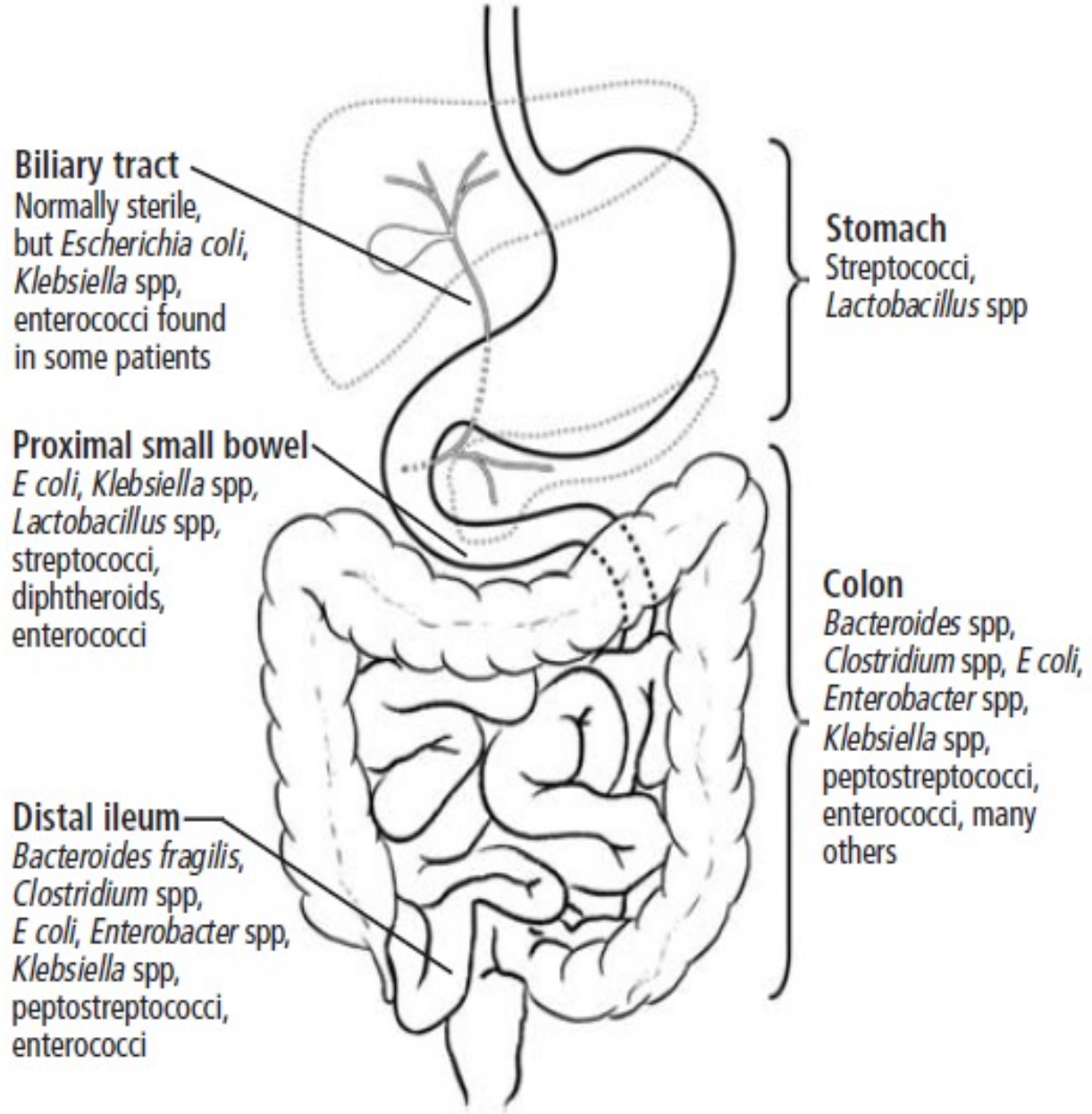
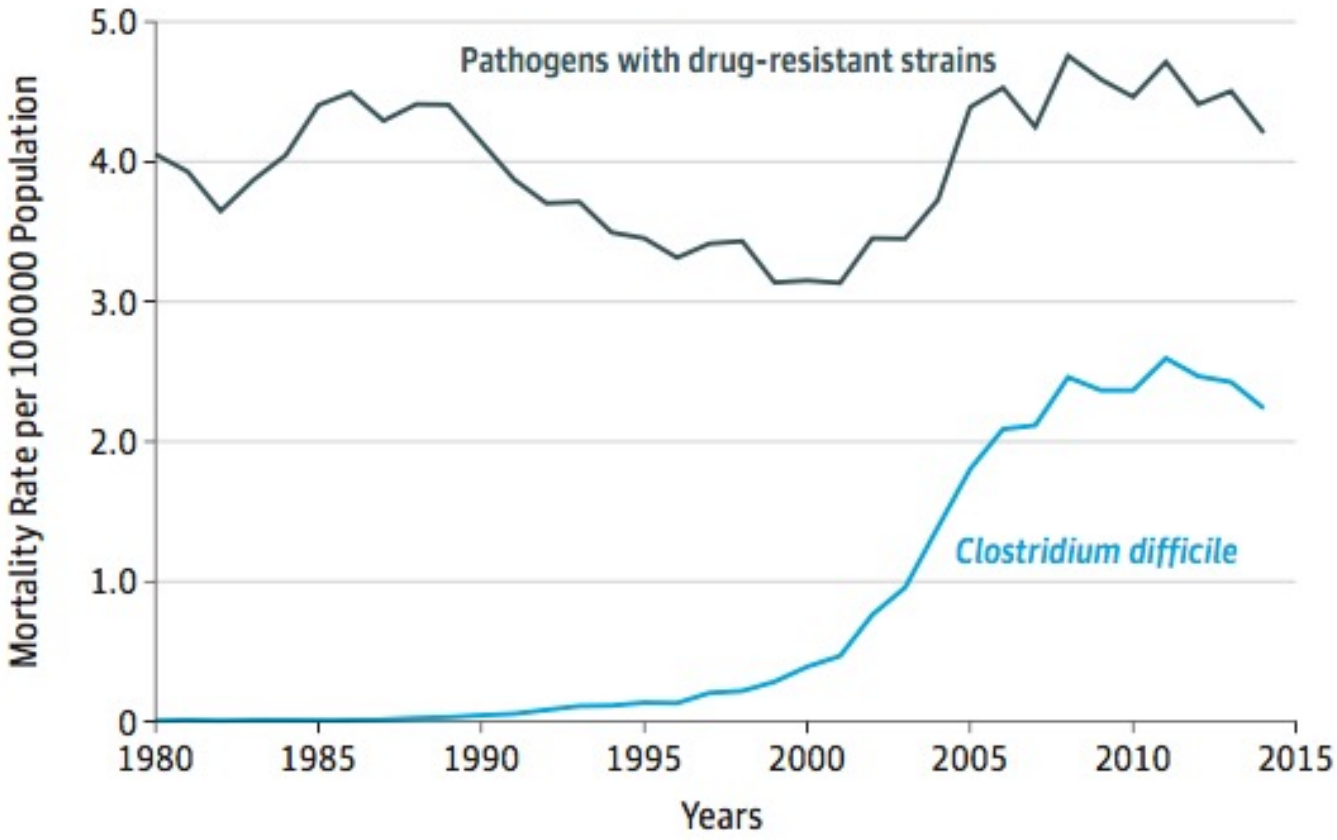


FIGURE 1. Usual microflora of the gastrointestinal tract.

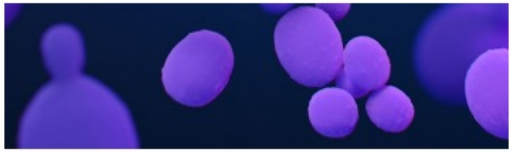
E Mortality due to pathogens with drug-resistant strains



Urgent Threats

These germs are public health threats that require urgent and aggressive action:

CARBAPENEM-RESISTANT
ACINETOBACTER



CANDIDA AURIS

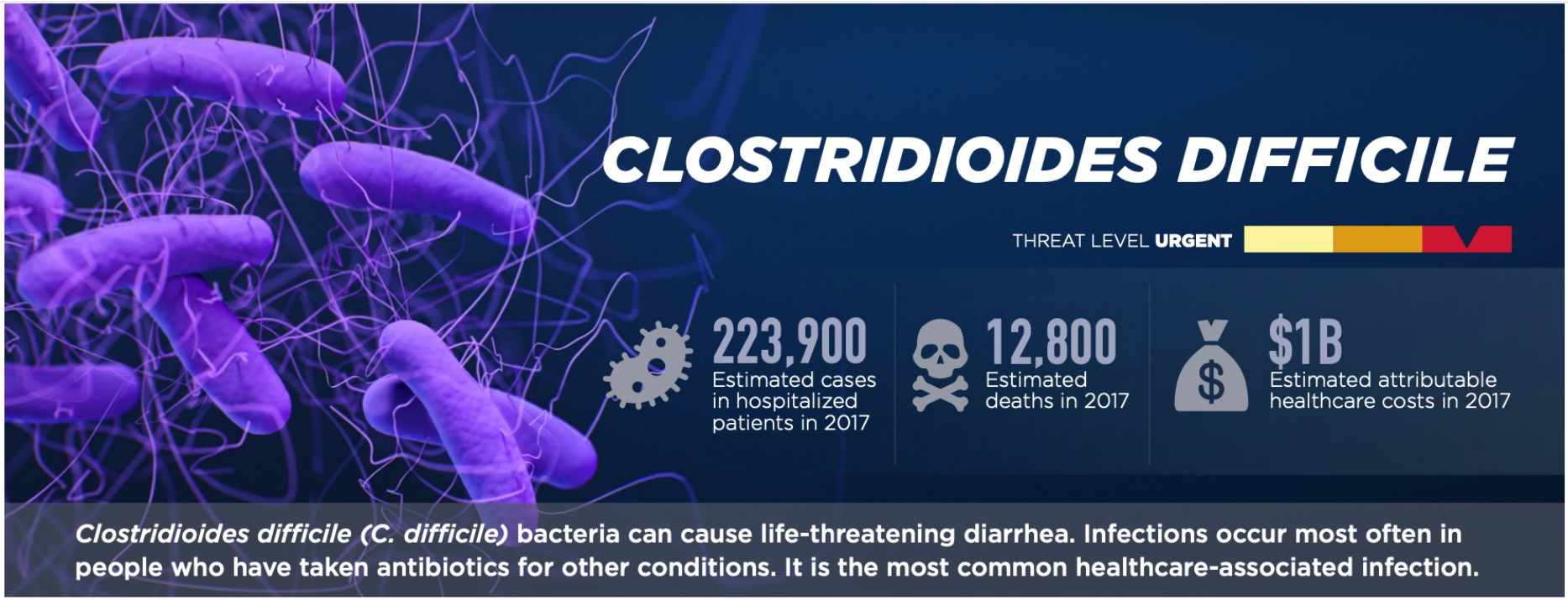
CLOSTRIDIOIDES DIFFICILE

CARBAPENEM-RESISTANT
ENTEROBACTERIACEAE

DRUG-RESISTANT
NEISSERIA GONORRHOEAE

ANTIBIOTIC RESISTANCE THREATS
IN THE UNITED STATES

2019



CLOSTRIDIOIDES DIFFICILE

THREAT LEVEL **URGENT**

223,900
Estimated cases in hospitalized patients in 2017

12,800
Estimated deaths in 2017

$1B
Estimated attributable healthcare costs in 2017

Clostridioides difficile (C. difficile) **bacteria can cause life-threatening diarrhea. Infections occur most often in people who have taken antibiotics for other conditions. It is the most common healthcare-associated infection.**

WHAT YOU NEED TO KNOW

- While healthcare-associated *C. difficile* cases are decreasing, community-associated cases are not.
- Strategies to reduce *C. difficile* infections include improving antibiotic use, infection control, and healthcare facility cleaning and disinfection.
- *C. difficile* infections are more common and tend to be more severe in older patients.

Previously *Clostridium difficile.* Also called *C. diff.* Cost includes hospital-onset cases only.

U.S. Department of Health and Human Services
Centers for Disease Control and Prevention

CASES OVER TIME

Continued appropriate infection control, antibiotic use, and diagnostic testing are important to maintain decreases in *C. difficile* cases.

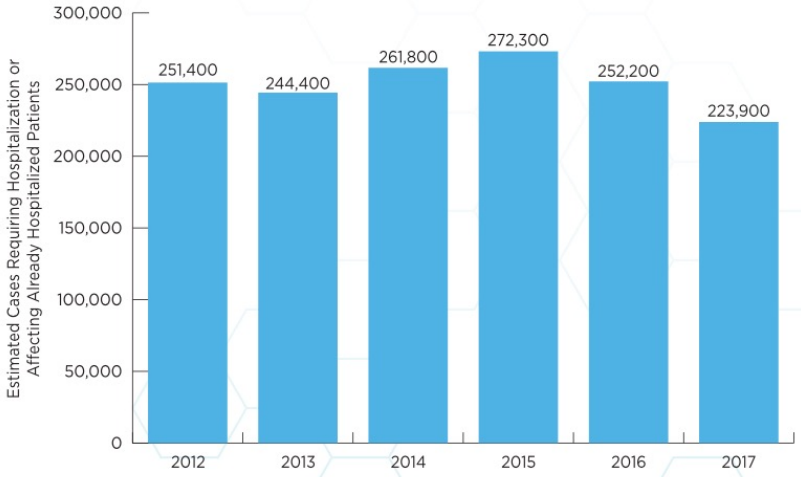


Table 1. Reported Cases of *Clostridioides difficile* Infection (CDI) and Crude Incidence, According to Epidemiologic Class, at 10 U.S. Emerging Infections Program Sites, 2011–2017.*

Surveillance Year	Population ≥1 Yr of Age	Community-Associated CDI		Health Care–Associated CDI		All CDI	
		No. of Cases	Incidence per 100,000 Persons	No. of Cases	Incidence per 100,000 Persons	No. of Cases	Incidence per 100,000 Persons
	no.						
2011	10,971,319	5284	48.16	10,177	92.76	15,461	140.92
2012†	11,283,326	5967	52.88	10,482	92.90	16,449	145.78
2013	11,552,955	6441	55.75	9,938	86.02	16,379	141.77
2014	11,533,856	6669	57.82	9,662	83.77	16,331	141.59
2015	11,682,427	7697	65.89	9,655	82.65	17,352	148.53
2016	11,777,482	7915	67.20	8,881	75.41	16,796	142.61
2017	11,906,512	7539	63.32	7,973	66.96	15,512	130.28

* The population for each surveillance year is based on estimates from the U.S. Census Bureau. The weighted frequency of cases in Colorado and Georgia was based on 33% random sampling for cases in persons 18 years of age or older.
† Data presented in the table exclude cases from Olmsted County, Minnesota, where CDI surveillance began midyear. The total number of reported CDI cases in 2012 would be 16,564 if CDI cases from Olmsted County, Minnesota, were included.

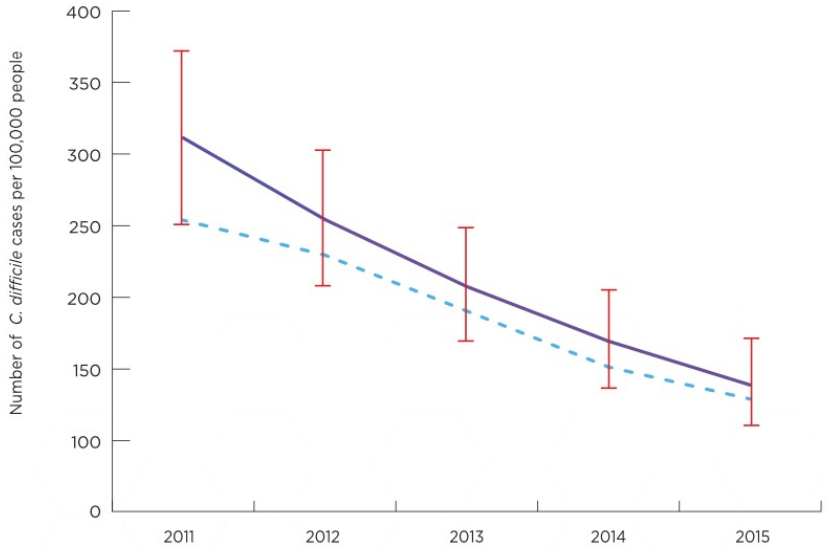
WHERE INFECTIONS HAPPEN

C. difficile infection affects thousands of people every year. It is rarely resistant to antibiotics; however, *C. difficile* usually occurs in people who have taken antibiotics. Improving antibiotic use is an important strategy to reduce these infections. Antibiotics disrupt (unbalance) our microbiome (a community of germs). A common strain of *C. difficile* (ribotype 027) that can cause more serious disease can be associated with use of certain antibiotics, such as fluoroquinolones.

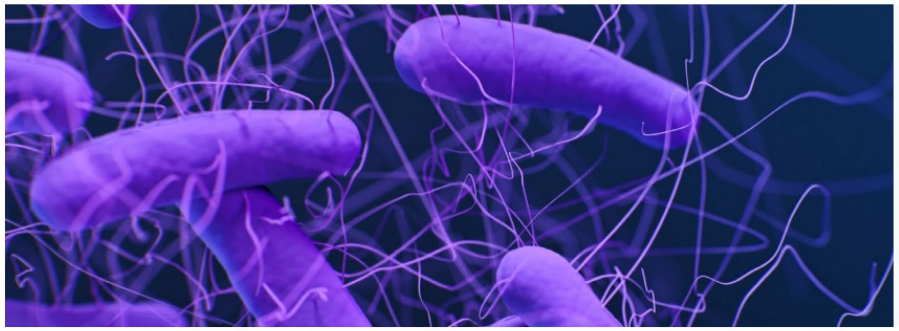
More than half of *C. difficile* cases among long-term care facility residents happen in those who were recently hospitalized. However, from 2011 to 2015, sites within CDC's Emerging Infections Program saw a decrease in *C. difficile* cases in people 65 years or older in long-term care facilities. During this same time, there were declines in hospital fluoroquinolone antibiotic use and *C. difficile* ribotype 027 among people 65 years or older. Improving antibiotic use may have contributed to the decrease in *C. difficile* cases.

C. DIFFICILE CASES

Improving antibiotic use may have contributed to the decrease in long-term care facility-onset *C. difficile* cases in 10 U.S. sites.



Adjusted cases for sex, race, and the percent of cases diagnosed by nucleic acid amplification test.

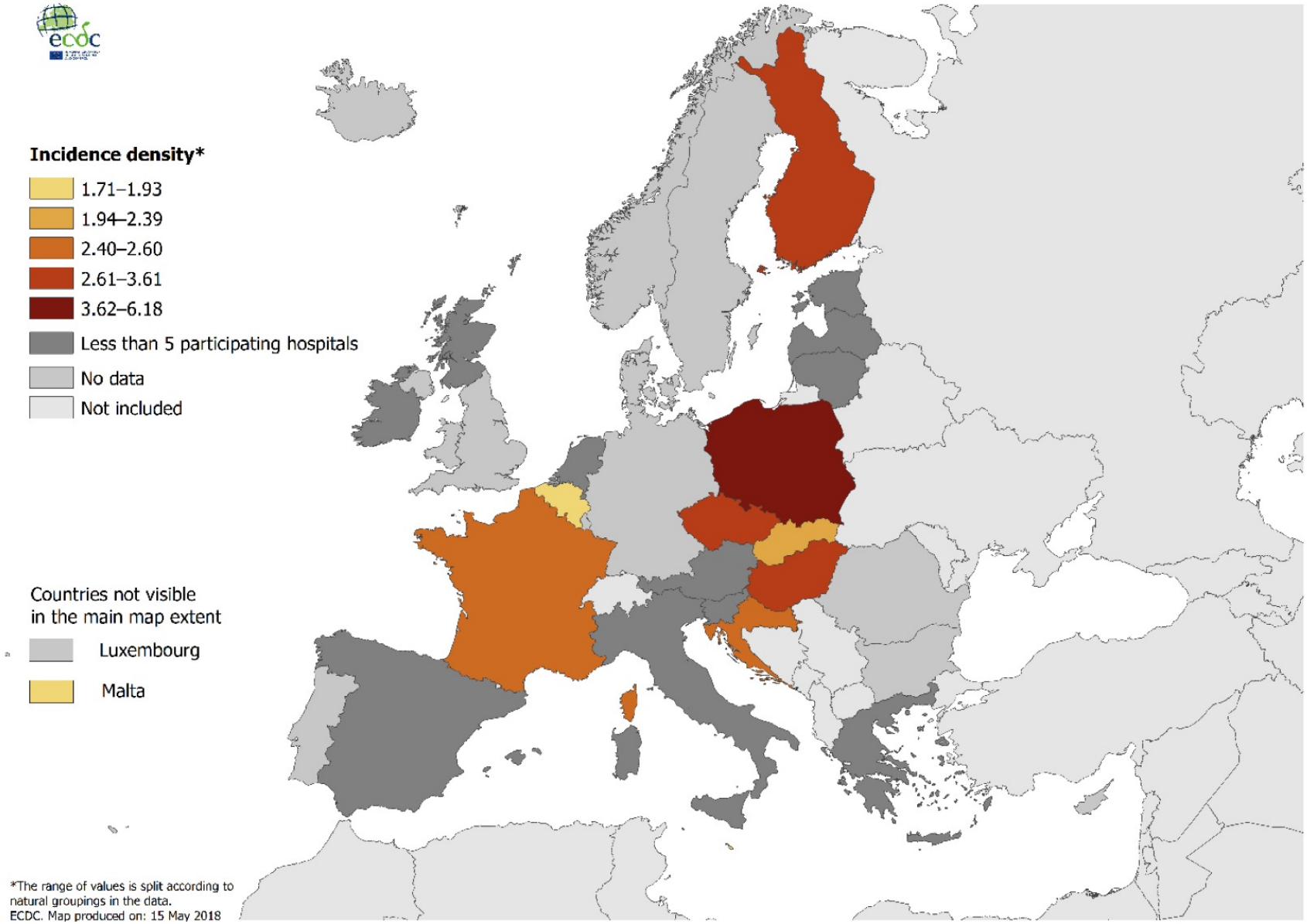


ONLINE RESOURCES

About *C. difficile* Infections
www.cdc.gov/cdiff/index.html

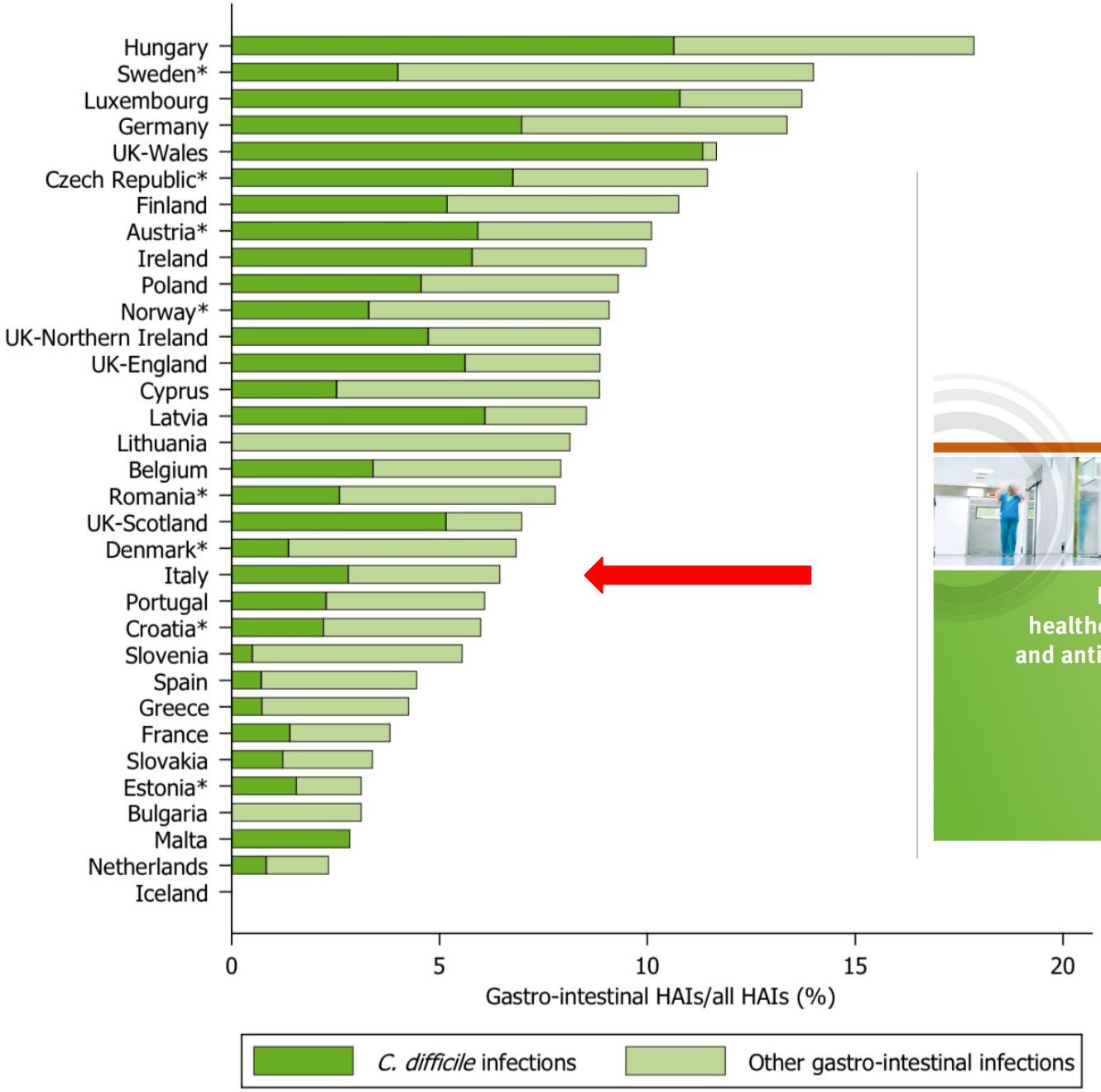
Tracking *C. difficile* Infections
www.cdc.gov/hai/eip/cdiff-tracking.html

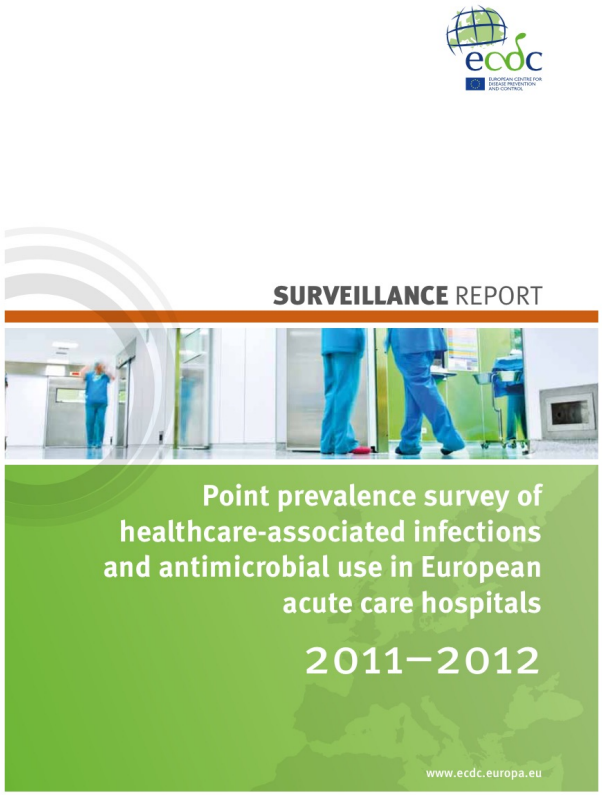
Figure 1. Healthcare-associated CDI cases per 10 000 patient-days in participating hospitals by country, EU/EEA, 2016



Source: Country reports from Austria, Belgium, Croatia, Czech Republic, Estonia, Finland, France, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Malta, the Netherlands, Poland, Slovakia, Slovenia, Spain, UK–Scotland.

Figure 3. ***Clostridium difficile*** **infections and other gastro-intestinal infections (excluding hepatitis) as a percentage of all HAIs, by country, ECDC PPS 2011–2012**





**PPS data representativeness was poor in Austria, Croatia, Czech Republic, Estonia, Norway and Romania and very poor in Denmark and Sweden.*

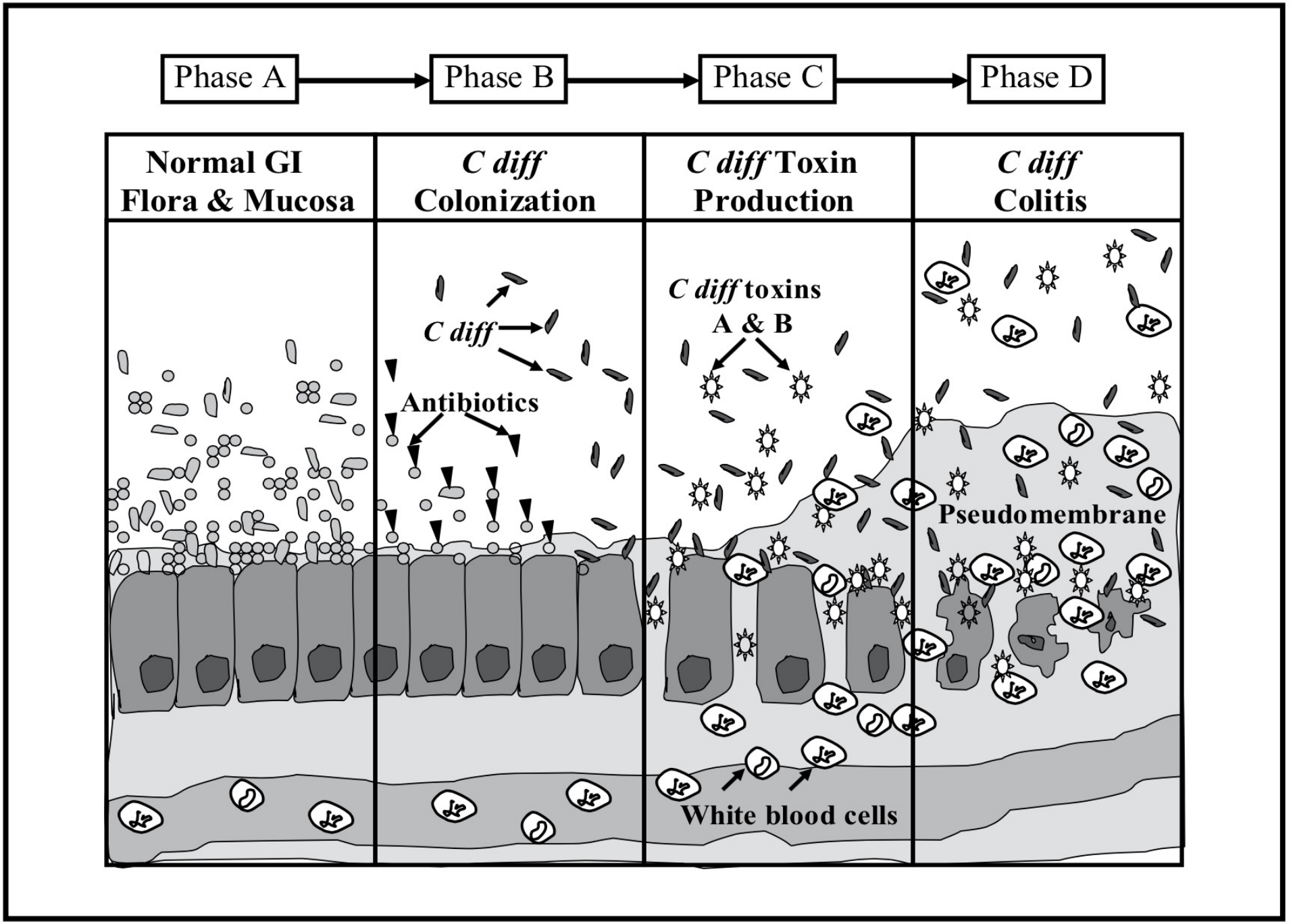
Clostridium difficile

- Bacillo gram positivo, anaerobio, sporigeno, presente nel suolo, nel tratto intestinale degli animali e nel 3% degli adulti sani.
- Hanno interesse clinico i ceppi che producono **tossina A e/o B**
- fa parte dei **Microrganismi "alert"**; il suo ritrovamento in pazienti ricoverati prevede misure di isolamento e precauzioni aggiuntive

Management must also include implementation of infection control policies. Patients with suspected or proven *C. difficile* infection should be placed on contact precautions, and healthcare workers should wash hands before and after patient contact. Hand hygiene with soap and water may be more effective than alcohol-based hand sanitizers in removing *C. difficile* spores, since *C. difficile* spores are resistant to killing by alcohol. Therefore, use of soap and water is favored over alcohol-based hand sanitization in the setting of a CDI outbreak.

UpToDate

Figure 10.1. Phases of pathogenesis of *C. difficile* colitis.



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Review

Risk factors for development of *Clostridium difficile* infection due to BI/NAP1/027 strain: a meta-analysis

Konstantinos Z. Vardakas [a,b], Athanasios A. Konstantelias [a,c], Giorgos Loizidis [a,d], Petros I. Rafailidis [a,b], Matthew E. Falagas [a,b,e,*]

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BI/NAP1/027

SUMMARY

Objective: To identify risk factors for the development of *Clostridium difficile* infection (CDI) due to *C. difficile* BI/NAP1/027 strain.
Methods: PubMed and Scopus databases were searched for studies that sought to identify risk factors for CDI due to the BI/NAP1/027 strain. The technique of meta-analysis was applied.
Results: Five studies compared CDI BI/NAP1/027 patients to CDI patients infected with non-BI/NAP1/027 strains, one compared CDI BI/NAP1/027 patients to non-CDI patients, and one provided data for both comparisons. The meta-analysis showed that fluoroquinolones were associated with a higher risk of CDI due to BI/NAP1/027 when compared to non-BI/NAP1/027 CDI (odds ratio (OR) 1.96, 95% confidence interval (95% CI) 1.37–2.80). A trend towards a lower risk for CDI due to BI/NAP1/027 was observed with cephalosporins when compared to non-BI/NAP1/027 CDI (OR 0.70, 95% CI 0.46–1.07). Prior macrolides were not associated with a higher risk for CDI BI/NAP1/027 when compared with non-BI/NAP1/027 CDI controls (OR 0.88, 95% CI 0.44–1.78). Clindamycin administration was associated with a lower risk for CDI due to BI/NAP1/027 when compared to non-BI/NAP1/027 CDI (OR 0.24, 95% CI 0.12–0.48). Age over 65 years was associated with an increased risk of CDI BI/NAP1/027 compared to non-BI/NAP1/027 CDI (OR 1.77, 95% CI 1.31–2.38).
Conclusions: Fluoroquinolones and age over 65 years were associated with a higher risk of CDI due to the BI/NAP1/027 strain. Clindamycin was associated with a lower risk of CDI due to BI/NAP1/027.

17103

Antimicrobial agents that may induce *Clostridioides* (formerly *Clostridium*) *difficile* diarrhea and colitis

Frequently associated	Occasionally associated	Rarely associated
▪ Fluoroquinolones ▪ Clindamycin ▪ Penicillins (broad spectrum) ▪ Cephalosporins*	▪ Macrolides ▪ Trimethoprim-sulfamethoxazole ▪ Sulfonamides	▪ Aminoglycosides ▪ Tetracyclines ▪ Chloramphenicol ▪ Metronidazole ▪ Vancomycin

* Use of 1 to 2 doses of a cephalosporin for surgical antibiotic prophylaxis does not confer significant risk for *C. difficile* infection.

UpToDate

PROBIOTICS

Recommendations

1. We recommend against probiotics for the prevention of CDI in patients being treated with antibiotics (primary prevention) (conditional recommendation, moderate quality of evidence).
2. We recommend against probiotics for the prevention of CDI recurrence (secondary prevention) (strong recommendation, very low quality of evidence).

Am J Gastroenterol 2021;116:1124–1147. https://doi.org/10.14309/ajg.0000000000001278; published online May 18, 2021

VIEWPOINT

The Probiotic Conundrum
Regulatory Confusion, Conflicting Studies, and Safety Concerns

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Cincinnati Children's Hospital Medical Center, Cincinnati, Ohio; and University of Cincinnati College of Medicine, Cincinnati, Ohio.

Phillip I. Tarr, MD
St Louis Children's Hospital, St Louis, Missouri; and Washington University in St Louis School of Medicine, St Louis, Missouri.

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It is increasingly clear that microbial communities have important functions in immunologic development, infection prevention, and intestinal barrier maintenance. These roles lend credence to the notion that probiotic (ie, live organisms that putatively benefit their host) administration can alter the human gut microbiome. Given that numerous meta-analyses and review articles and marketing are supportive of probiotics, it is easy to understand why medical professionals adopt "can't hurt, might help" attitudes toward these substances. However, the paucity of high-quality data supporting the value of probiotics, concerns about potentially biased reviews of their efficacy, the complex framework in which probiotics are regulated and sold, and the limited but increasingly concerning safety information suggest that this approach may not be appropriate.

To understand the contradiction between enthusiasm for probiotics and the lack of data supporting use of these products, it is helpful to first examine the regulatory environment in which they are sold. In the United States, the primary regulatory authority is the US Food and Drug Administration (FDA), which, despite the size of the industry (annual worldwide revenues expected to exceed US $64 billion[1]), has no central office to oversee probiotics. Nonetheless, physicians and the public may mistakenly assume that probiotics available for purchase are subject to stringent regulatory oversight.

The FDA categorizes products by the type of claims a manufacturer makes on their behalf, not by ingredients or other properties. If a manufacturer claims that any product, including a probiotic, cures, mitigates, treats, or prevents disease, the product is classified as a drug, thereby triggering a costly Investigational New Drug (IND) application process. Similarly, investigator-initiated human studies seeking to determine if a probiotic cures, mitigates, treats, or prevents a disease are considered drug trials and require an IND application, even if the administered intervention has a record of safety in the target population. These requirements pose barriers for researchers who are obliged to provide propriety manufacturing information (ie, Drug Master File, information held by the manufacturer) to the FDA as part of the IND application process. Thus, a company can block a study by simply withholding documentation, such as by not permitting researchers to include proprietary information about a product.

This regulatory framework has led to the marketing of probiotics as dietary supplements. This approach permits their manufacturers to make structure-function claims without FDA approval. Such claims link the probiotic to a body function using words such as "may help" or "promotes." Products that make structure-function claims (such as "helps your digestive system work better" or "promotes health and wellness"), which most consumers find difficult to distinguish from FDA-approved health claims (such as for sumatriptan succinate, "indicated for the acute treatment of migraine attacks with or without aura in adults"), must include a disclaimer indicating that their statements have not been evaluated by the FDA and are not intended to diagnose, treat, or prevent disease. Nonetheless, many consumers erroneously believe that supplements such as probiotics have had their contents analyzed for purity, have been tested for safety and effectiveness, and are approved by the FDA for use as claimed.

Barriers to high-quality clinical research on probiotics are magnified by the "locked-in" provision, which prohibits marketing a substance as a food product if it is first studied under an IND, even if the study is designed to support use of that product as a food rather than a drug. However, the FDA offers a loophole whereby marketing a substance as a dietary supplement or food before seeking an IND (ie, not conducting research that triggers an IND requirement) or beginning any clinical investigation preserves the option to continue to market the substance in those forms after substantial clinical investigations take place, even if the results demonstrate no benefit. These provisions dissuade manufacturers and researchers from rigorously evaluating structure-function probiotic claims. Instead, claims remain subject to the requirements of the food categorization of probiotics. Given all the aforementioned barriers, the FDA has not yet approved any probiotic products as live biotherapeutic agents.[2] However, because the public consumes probiotics under the assumptions of their effectiveness, safety, and government certification, a more stringent regulatory framework is required.

Because high-quality trials that evaluate probiotic efficacy are difficult to conduct, there are few data supporting efficacy claims. Moreover, given the public's perception of structure-function claims, and the successful market for probiotics, manufacturers have little incentive to generate evidence supporting their use. PubMed searches contrast the increasing number of articles on probiotics (3495 in 2019 vs 2658 in 2018, a 31% increase) with the decreasing number reporting human clinical trials of probiotics (185 in 2019, the least since 2012, and a decrease of 92 since 2018 using PubMed search term *probiotic human clinical trial*). There are additional disturbing trends in the literature. Earlier trials, generally with high risk of bias, have favored probiotics for a myriad of conditions, while the preponderance of more recent, low-risk-of-bias trials fail to support earlier positive findings.[3] These sobering reversals of conclusions cast doubt on "might help" premises.

Meta-analyses, which attempt to clarify decision-making in the face of inconsistent or underpowered trials, can be highly misleading. As has been pointed out, meta-analyses, which include small, unreliable trials, often lend

Risk and Safety of Probiotics

Shira Doron and David R. Snydman

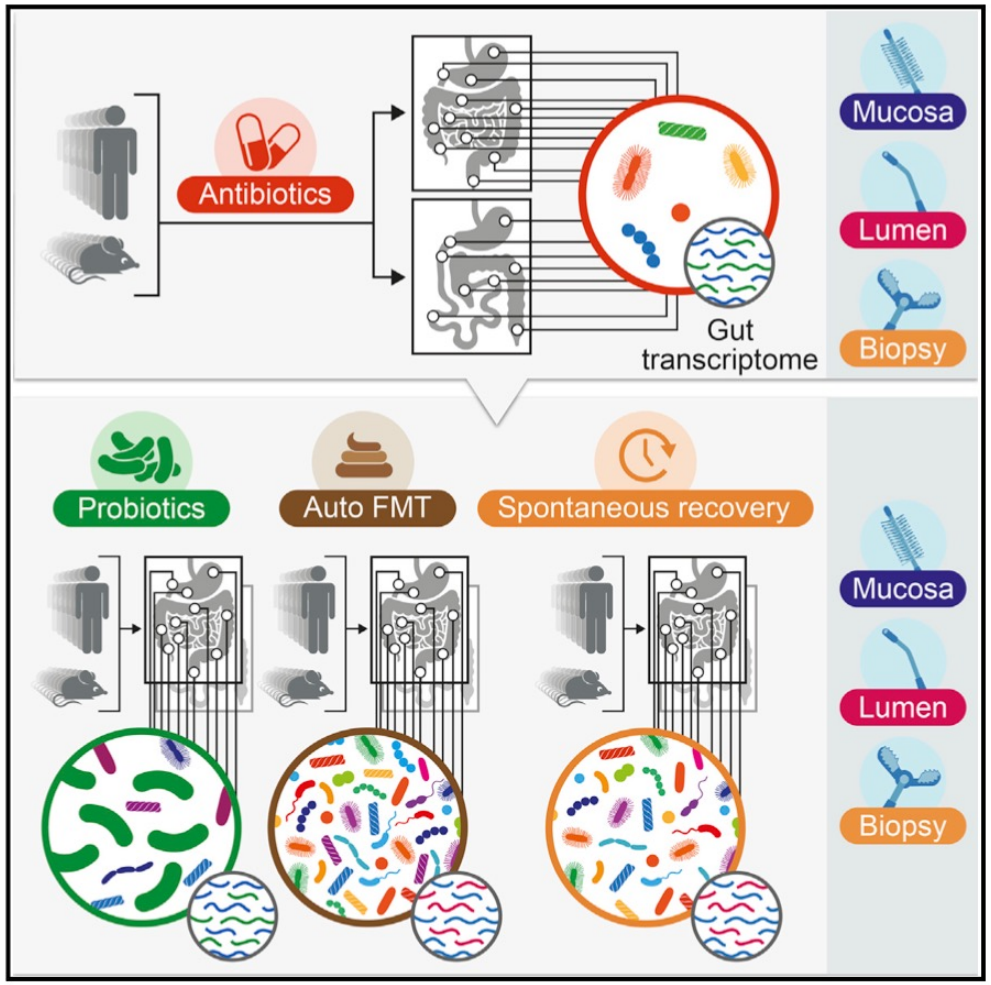
Division of Infectious Diseases, Tufts Medical Center, Boston, Massachusetts

Probiotics have been used safely for years. Safety outcomes are inconsistently reported in published clinical trials. In 2011, a report released by the Agency for Healthcare Research and Quality concluded that, although the existing probiotic clinical trials reveal no evidence of increased risk, "the current literature is not well equipped to answer questions on the safety of probiotics in intervention studies with confidence." Critics point out that the preponderance of evidence, including the long history of safe probiotic use as well as data from clinical trials, and animal and in vitro studies all support the assumption that probiotics are generally safe for most populations. Theoretical risks have been described in case reports, clinical trial results and experimental models, include systemic infections, deleterious metabolic activities, excessive immune stimulation in susceptible individuals, gene transfer and gastrointestinal side effects. More research is needed to properly describe the incidence and severity of adverse events related to probiotics.

Cell

Post-Antibiotic Gut Mucosal Microbiome Reconstitution Is Impaired by Probiotics and Improved by Autologous FMT

Graphical Abstract



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In Brief

Probiotics perturb rather than aid in microbiota recovery back to baseline after antibiotic treatment in humans.

Suez et al., 2018, Cell *174*, 1406–1423
September 6, 2018
https://doi.org/10.1016/j.cell.2018.08.047

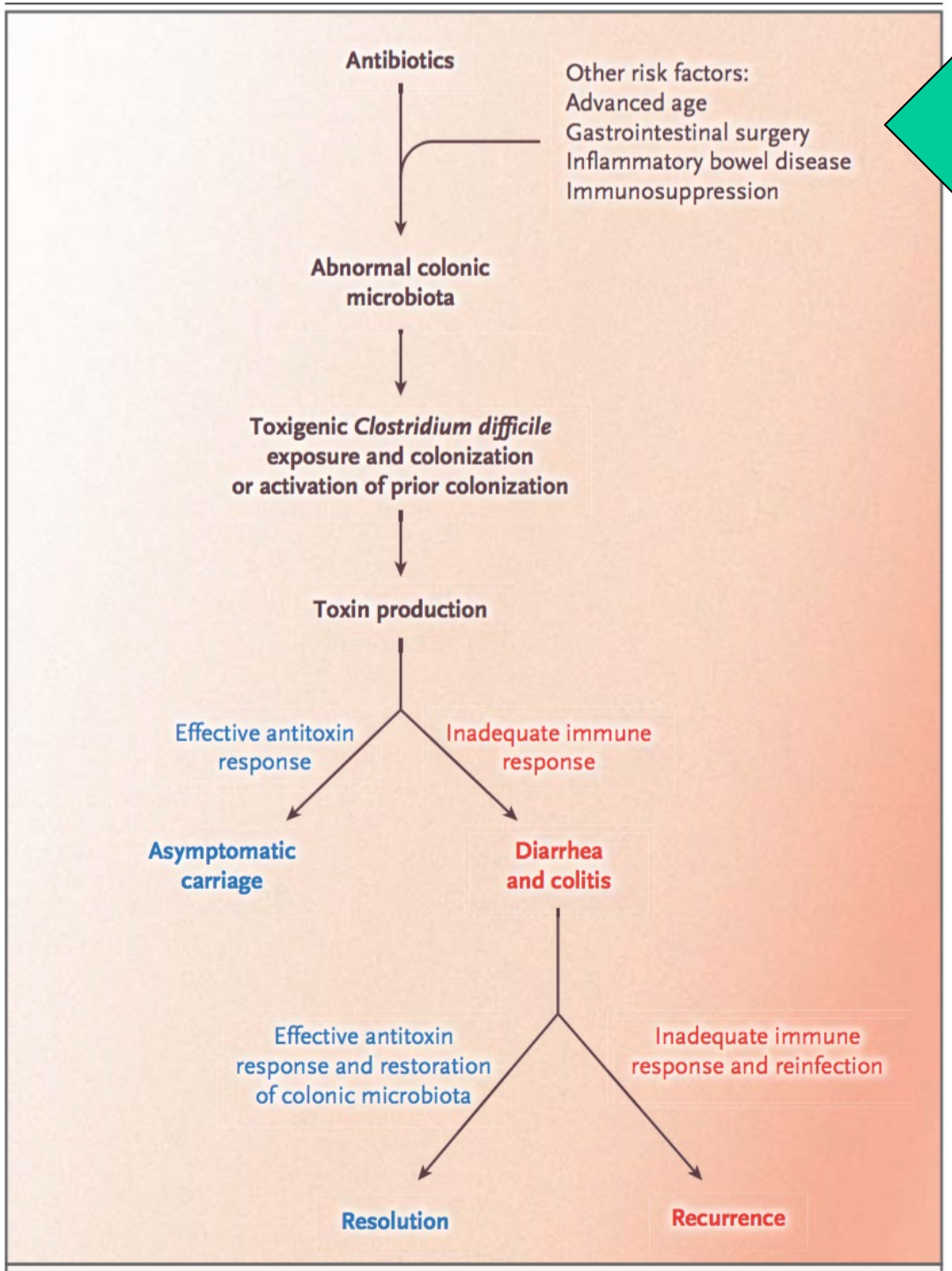


Figure 1. Pathogenesis of *Clostridium difficile* Infection.

Il ruolo dell'età dei pazienti

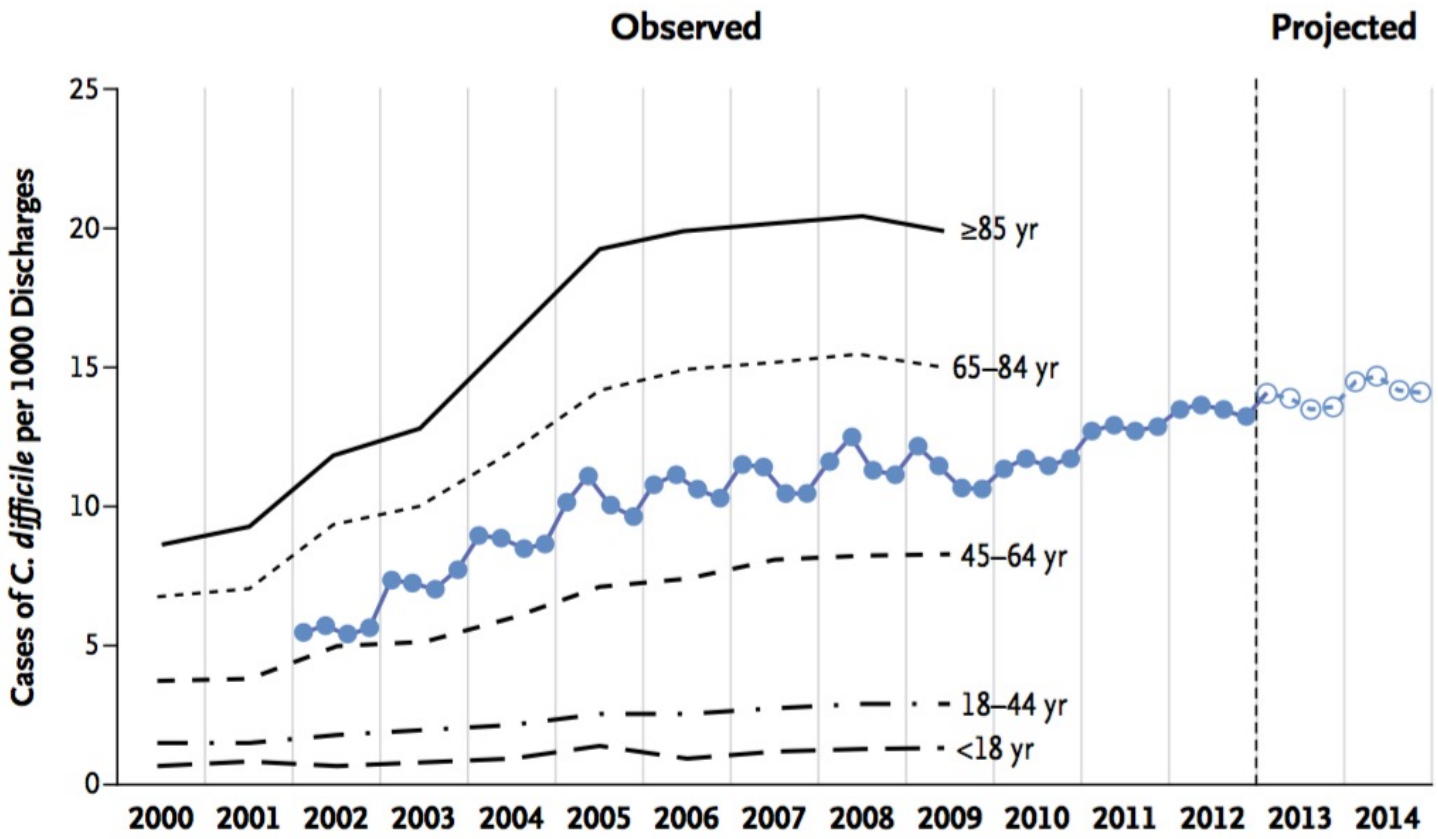


Figure 2. Incidence of Nosocomial *Clostridium difficile* Infection.

The overall incidence of nosocomial *C. difficile* infection is shown by year (blue), as is the incidence according to patient age (black). Data are from Steiner et al.[18] and Lessa et al.[24]

XXV. What is the role of antibiotic stewardship in controlling CDI rates?

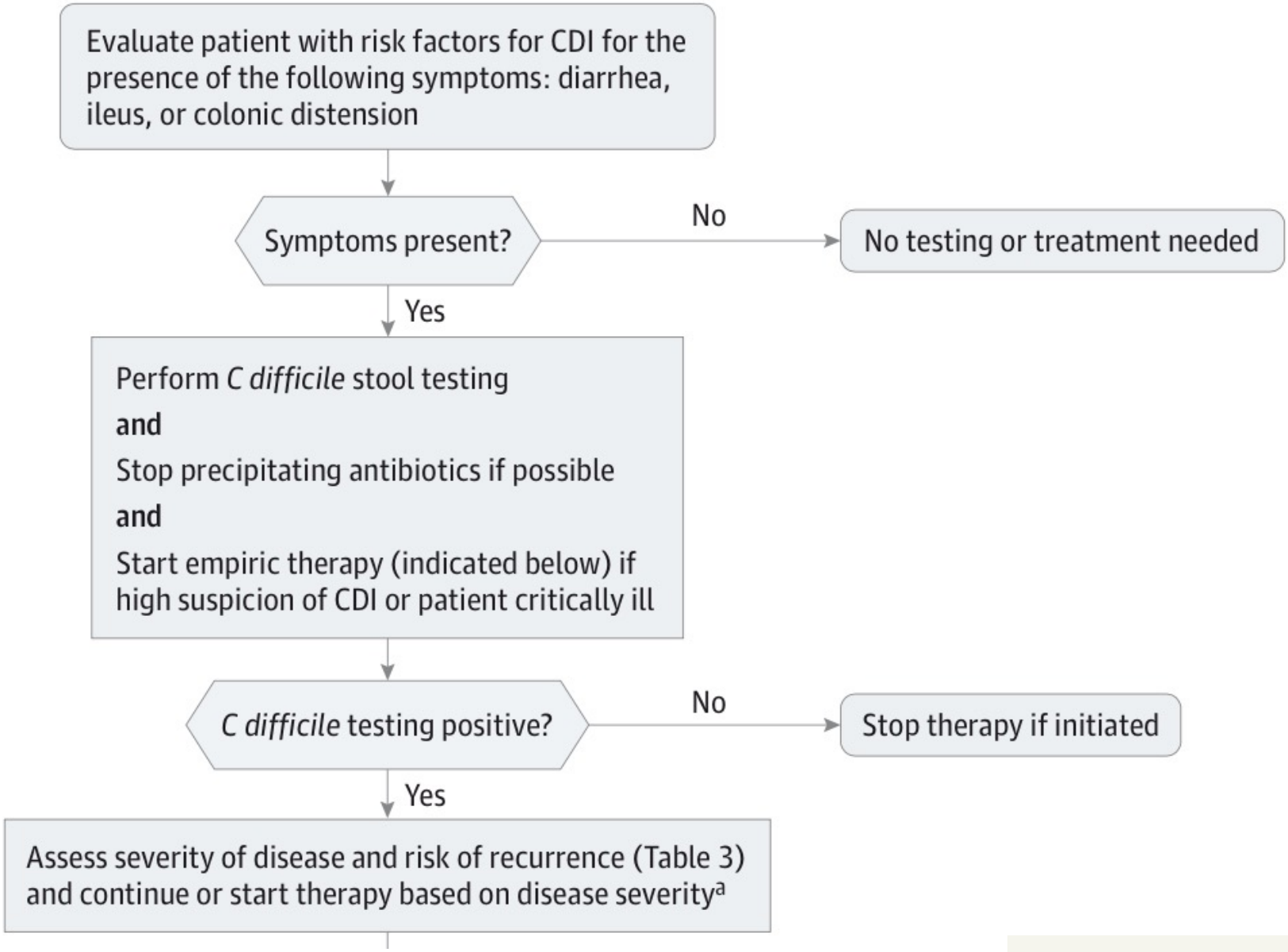
Recommendations

1. Minimize the frequency and duration of high-risk antibiotic therapy and the number of antibiotic agents prescribed, to reduce CDI risk *(strong recommendation, moderate quality of evidence)*.
2. Implement an antibiotic stewardship program *(good practice recommendation)*.
3. Antibiotics to be targeted should be based on the local epidemiology and the *C. difficile* strains present. Restriction of fluoroquinolones, clindamycin, and cephalosporins (except for surgical antibiotic prophylaxis) should be considered *(strong recommendation, moderate quality of evidence)*.

XXVI. What is the role of proton pump inhibitor restriction in controlling CDI rates?

Recommendation

1. Although there is an epidemiologic association between proton pump inhibitor (PPI) use and CDI, and unnecessary PPIs should always be discontinued, there is insufficient evidence for discontinuation of PPIs as a measure for preventing CDI *(no recommendation)*.



JAMA. 2015;313(4):398-408. doi:10.1001/jama.2014.17103

Clostridium difficile

La ricerca è indicata in:

pazienti ricoverati che presentano diarrea insorta dopo almeno 2 giorni di ricovero, oppure diarrea insorta entro le prime 48 ore, se dimessi da un ospedale

pazienti ambulatoriali con diarrea dimessi da un ospedale da non più di 4 settimane

pazienti con diarrea grave ndd.

Non effettuare la ricerca nei campioni di feci di soggetti asintomatici.

Non effettuare test dopo il trattamento a conferma della guarigione. Quando si sospetta una recidiva, ripetere il test per C. difficile, ma escludere anche altre cause possibili di diarrea.

Clostridium difficile

La diagnosi si basa sulla ricerca nelle feci di C. difficile e/o di suoi antigeni, tossine o acidi nucleici.

- Ricerca dell'antigene comune (glutammato deidrogenasi - GDH), indice di presenza di C. difficile. Il test è dotato di buona sensibilità, ma, in caso di positività, richiede conferma con un test in grado di evidenziare la presenza delle tossine A e B.

- Ricerca delle tossine A e B: sensibilità non elevata (75%), buona specificità (90%-100%); inoltre le tossine si degradano rapidamente se il campione non viene conservato a 2° - 8° C

- Amplificazione di acidi nucleici (NAAT): sono disponibili in commercio test in PCR real-time in grado di identificare, a partire dal campione, anche i ceppi ipervirulenti. L'automazione delle fasi di estrazione, amplificazione e lettura, insieme al tempo di esecuzione (poco più di un'ora) ne fanno il test diagnostico ideale; il costo è più elevato.

Original Investigation

Overdiagnosis of *Clostridium difficile* Infection in the Molecular Test Era

Christopher R. Polage, MD, MAS; Clare E. Gyorke, BS; Michael A. Kennedy, BS; Jhansi L. Leslie, BS; David L. Chin, PhD; Susan Wang, BS; Hien H. Nguyen, MD, MAS; Bin Huang, MD, PhD; Yi-Wei Tang, MD, PhD; Lenora W. Lee, MD; Kyoungmi Kim, PhD; Sandra Taylor, PhD; Patrick S. Romano, MD, MPH; Edward A. Panacek, MD, MPH; Parker B. Goodell, BS, MPH; Jay V. Solnick, MD, PhD; Stuart H. Cohen, MD

IMPORTANCE *Clostridium difficile* is a major cause of health care–associated infection, but disagreement between diagnostic tests is an ongoing barrier to clinical decision making and public health reporting. Molecular tests are increasingly used to diagnose *C difficile* infection (CDI), but many molecular test-positive patients lack toxins that historically defined disease, making it unclear if they need treatment.

OBJECTIVE To determine the natural history and need for treatment of patients who are toxin immunoassay negative and polymerase chain reaction (PCR) positive (Tox−/PCR+) for CDI.

DESIGN, SETTING, AND PARTICIPANTS Prospective observational cohort study at a single academic medical center among 1416 hospitalized adults tested for *C difficile* toxins 72 hours or longer after admission between December 1, 2010, and October 20, 2012. The analysis was conducted in stages with revisions from April 27, 2013, to January 13, 2015.

MAIN OUTCOMES AND MEASURES Patients undergoing *C difficile* testing were grouped by US Food and Drug Administration–approved toxin and PCR tests as Tox+/PCR+, Tox−/PCR+, or Tox−/PCR−. Toxin results were reported clinically. Polymerase chain reaction results were not reported. The main study outcomes were duration of diarrhea during up to 14 days of treatment, rate of CDI-related complications (ie, colectomy, megacolon, or intensive care unit care) and CDI-related death within 30 days.

RESULTS Twenty-one percent (293 of 1416) of hospitalized adults tested for *C difficile* were

CONCLUSIONS AND RELEVANCE Among hospitalized adults with suspected CDI, virtually all CDI-related complications and deaths occurred in patients with positive toxin immunoassay test results. Patients with a positive molecular test result and a negative toxin immunoassay test result had outcomes that were comparable to patients without *C difficile* by either method. Exclusive reliance on molecular tests for CDI diagnosis without tests for toxins or host response is likely to result in overdiagnosis, overtreatment, and increased health care costs.

Invited Commentary page 1801

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Clostridium difficile

Sistema in uso:

- test immunocromatografico per la ricerca rapida dell'antigene GDH
- Real Time PCR per la ricerca combinata di tossina B, tossina binaria e del ceppo ipervirulento NAP1-027

Table 3. CDI Classification Based on Disease Severity

CDI Disease Category	Clinical and Laboratory Signs	Associated Risk Factors
Mild to moderate	Diarrhea without systemic signs of infection, white blood cell count <15 000 cells /mL, and serum creatinine <1.5 times baseline[15]	Antibiotic use, previous hospitalization, longer duration of hospitalization, use of proton pump inhibitors, receipt of chemotl kidney c of a feec
Severe	Systemic signs of infection, and/or white blood cell count ≥15 000 cells/mL, or serum creatinine ≥1.5 times the premorbid level[15]	Advance BI/NAP1
Severe, complicated	Systemic signs of infection including hypotension, ileus, or megacolon[15]	See above,[a] plus recent surgery, history of inflammatory bowel disease, and intravenous immunoglobulin treatment[43]
Recurrent	Recurrence within 8 weeks of successfully completing treatment for CDI[16,20]	Patient age ≥65 y, concomitant antibiotic use, presence of significant comorbidities, concomitant use of proton pump inhibitors, and increased initial disease severity[16]

CLASSIFICATION OF CDI

Key concepts

2. We recommend the following criteria, which are predictive of unfavorable outcomes, be used to classify severe *C. difficile* infection at the time of diagnosis: white blood cell (WBC) ≥15,000 cells/mm^3 or serum creatinine >1.5 mg/dL.
3. We recommend defining fulminant infection as patients meeting criteria for severe *C. difficile* infection plus presence of hypotension or shock or ileus or megacolon.

Am J Gastroenterol 2021;116:1124–1147.

JAMA. 2015;313(4):398-408. doi:10.1001/jama.2014.17103

Table 1. Recommendations for the Treatment of *Clostridium difficile* Infection in Adults

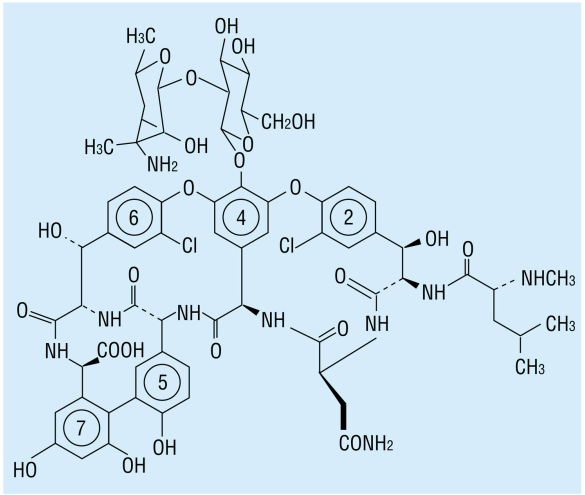
Clinical Definition	Supportive Clinical Data	Recommended Treatment[a]	Strength of Recommendation/ Quality of Evidence
Initial episode, non-severe	Leukocytosis with a white blood cell count of ≤15000 cells/mL and a serum creatinine level <1.5 mg/dL	• VAN 125 mg given 4 times daily for 10 days, OR	Strong/High
		• FDX 200 mg given twice daily for 10 days	Strong/High
		• Alternate if above agents are unavailable: metronidazole, 500 mg 3 times per day by mouth for 10 days	Weak/High
Initial episode, severe[b]	Leukocytosis with a white blood cell count of ≥15000 cells/mL or a serum creatinine level >1.5 mg/dL	• VAN, 125 mg 4 times per day by mouth for 10 days, OR	Strong/High
		• FDX 200 mg given twice daily for 10 days	Strong/High
Initial episode, fulminant	Hypotension or shock, ileus, megacolon	• VAN, 500 mg 4 times per day by mouth or by nasogastric tube. If ileus, consider adding rectal instillation of VAN. Intravenously administered metronidazole (500 mg every 8 hours) should be administered together with oral or rectal VAN, particularly if ileus is present.	Strong/Moderate (oral VAN); Weak/Low (rectal VAN); Strong/Moderate (intravenous metronidazole)
First recurrence	…	• VAN 125 mg given 4 times daily for 10 days if metronidazole was used for the initial episode, OR	Weak/Low
		• Use a prolonged tapered and pulsed VAN regimen if a standard regimen was used for the initial episode (eg, 125 mg 4 times per day for 10–14 days, 2 times per day for a week, once per day for a week, and then every 2 or 3 days for 2–8 weeks), OR	Weak/Low
		• FDX 200 mg given twice daily for 10 days if VAN was used for the initial episode	Weak/Moderate
Second or subsequent recurrence	…	• VAN in a tapered and pulsed regimen, OR	Weak/Low
		• VAN, 125 mg 4 times per day by mouth for 10 days followed by rifaximin 400 mg 3 times daily for 20 days, OR	Weak/Low
		• FDX 200 mg given twice daily for 10 days, OR	Weak/Low
		• Fecal microbiota transplantation[c]	Strong/Moderate

Abbreviations: FDX, fidaxomicin; VAN, vancomycin.

[a]All randomized trials have compared 10-day treatment courses, but some patients (particularly those treated with metronidazole) may have delayed response to treatment and clinicians should consider extending treatment duration to 14 days in those circumstances.

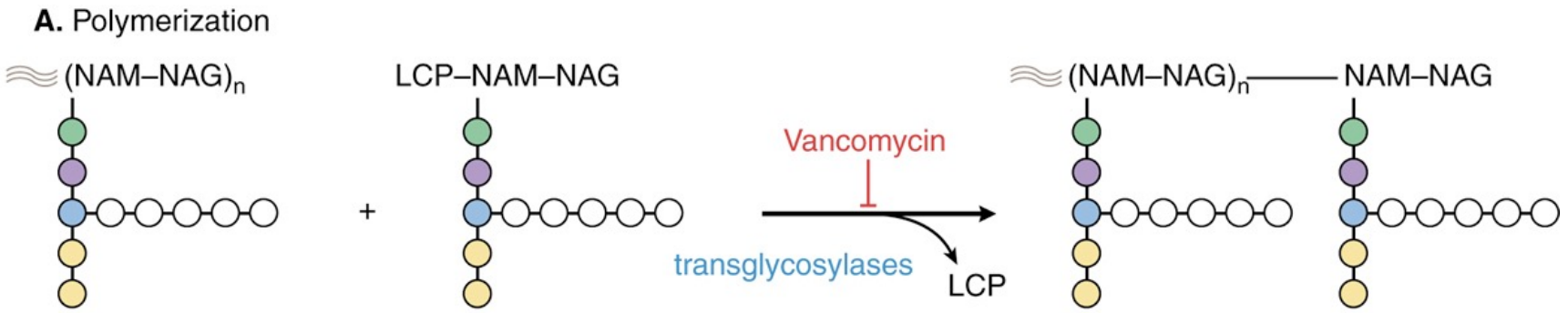
[b]The criteria proposed for defining severe or fulminant *Clostridium difficile* infection (CDI) are based on expert opinion. These may need to be reviewed in the future upon publication of prospectively validated severity scores for patients with CDI.

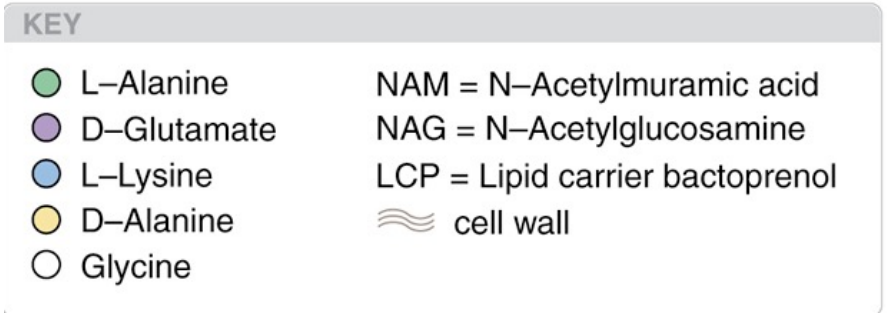
[c]The opinion of the panel is that appropriate antibiotic treatments for at least 2 recurrences (ie, 3 CDI episodes) should be tried prior to offering fecal microbiota transplantation.

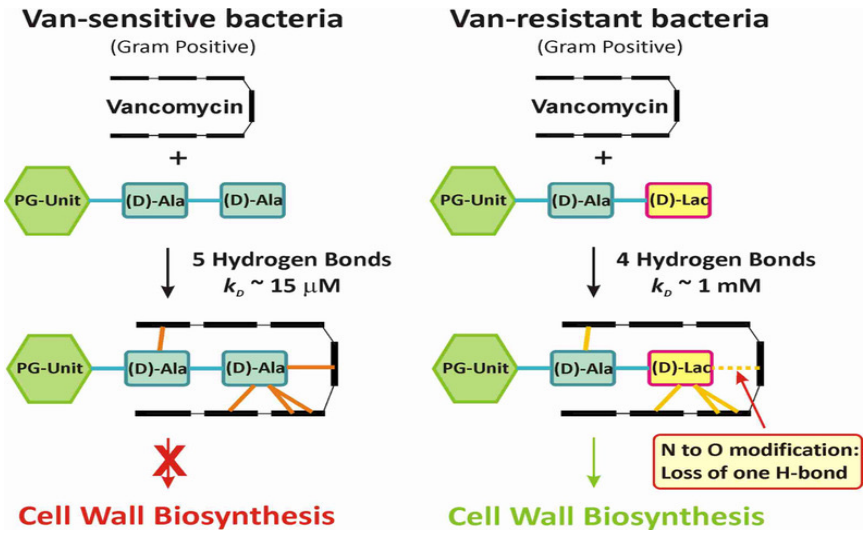


vancomicina

Vancocina®…







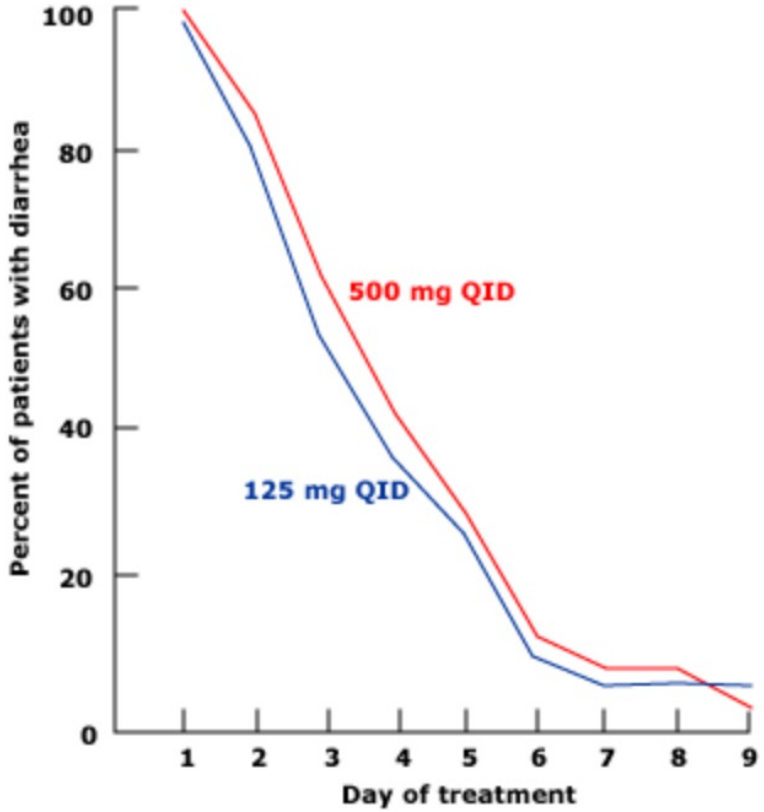
Glicopeptidi: spettro di attività

- Batteri Gram+
  - *Staphylococcus aureus m.s.*
  - *Staphylococcus aureus m.r.*
  - *Staphylococcus epidermidis*
  - *Streptococcus pyogenes*
  - *Streptococcus pneumoniae*
  - Viridans streptococci
  - *Enterococcus faecalis*
  - ***Clostridium difficile***
  - *Coryebacterium jeikeium*
- *Batteri Gram-: **sono resistenti***

Vancomicina orale: farmacocinetica

- **Non viene assorbiti se somministrati per os**
- Posologia 125 mg p.o. ogni 6 ore per 10 – 14 g
- Se il paziente è in terapia con altri antibiotici continuare il trattamento con vancomicina (o metronidazolo) per una settimana dopo la sospensione degli altri antibiotici.

High- and low-dose oral vancomycin are equally effective in acute *Clostridium difficile* colitis



Disappearance of diarrhea was identical in patients with acute *C. difficile* colitis who received either high- (500 mg four times daily, red line) or low- (125 mg four times daily, blue line) dose oral vancomycin for 10 days.

QID: four times daily.

Redrawn from Fekety R, Silva J, Kauffman C, et al. Am J Med 1989; 86:15.

Glicopeptidi

Farmaco	Biodisponibilità (%)	$t\frac{1}{2}$ normale	$t\frac{1}{2}$ IR
Vancomicina	-	5.7	139.1
Teicoplanina	-	91.6	206

Farmaco	Dose
Vancomicina i.v.	30 mg/kg/die in 2-4 somm.
Vancomicina p.o.	0.5-1 g/die in 4 somm.
Teicoplanina i.v. o i.m.	6-30 mg/kg/die in 1-2 somm

Dosaggi ematici dei glicopeptidi		
Farmaco	Concentrazione allo SS	Concentrazione max
Vancomicina	5-15 μg/ml	< 60 μg/ml
Teicoplanina	15-20 μg/ml	

Glicopeptidi: effetti collaterali

- **Tossicità scarsissima per somministrazione orale.**
- Ototossicità spesso irreversibile
- Nefrotossicità (rara, reversibile)
- La vancomicina (per e.v.) è un liberatore di istamina:
  - Sindrome dell' uomo rosso
  - Sindrome del collo rosso
  - Ipotensione

Risk Factors for Systemic Vancomycin Exposure Following Administration of Oral Vancomycin for the Treatment of *Clostridium difficile* Infection

Natasha N. Pettit,[1,2] Daryl D. DePestel,[1,2] Alexander L. Fohl,[1,2] Rachel Eyler,[1,2] and Peggy L. Carver[1,2,*]

[1]Department of Clinical, Social and Administrative Sciences, University of Michigan College of Pharmacy, Ann Arbor, Michigan; [2]Department of Pharmacy Services, University of Michigan Health System, Ann Arbor, Michigan

Objective To identify risk factors for systemic exposure to vancomycin (VAN) following administration of oral vancomycin (POV) for the treatment of *Clostridium difficile* infection (CDI).

Design Prospective, observational, single-center case series.

Setting Academic medical center.

Patients Hospitalized patients with suspected or confirmed CDI who received POV for at least 5 days.

Intervention Random VAN serum levels were obtained on days 5, 10, and weekly thereafter in patients treated for ≥ 5 days with POV without concomitant intravenous VAN.

Measurements and Results Of 117 random VAN serum levels from 85 patients, 58 patients (68.2%) had one or more detectable (≥ 0.05 μg/ml) levels and 15 (17.6%) of 85 patients had one or more levels > 2.5 μg/ml. Risk factors for detectable VAN exposure following administration of POV included POV dosages > 500 mg/day (odds ratio [OR] 35.83, 95% confidence interval [CI] 7.56–169.8), the presence of severe CDI (OR 4.11, 95% CI 2.76–10.83, p=0.028), intensive care unit (ICU) admission (OR 3.80, 95% CI 1.02–14.21, p=0.032), and the administration of POV ≥ 10 days (OR 6.71, 95% CI 1.81–24.83, p=0.0025). Risk factors for exposure to serum VAN concentrations > 2.5 μg/ml included the presence of gastrointestinal (GI) pathology (OR 5.22, 95% CI 3.45–18.3, p=0.031), ICU admission (OR 3.21, 95% CI 1.40–10.28, p=0.022), the use of VAN retention enemas (OR 4.73, 95% CI 2.42–20.39, p=0.036), and having a creatinine clearance ≤ 50 ml/minute or undergoing hemodialysis or continuous renal replacement therapy (OR 4.03, 95% CI 1.26–12.84, p=0.039).

Conclusions Serum VAN levels were detected in 58 (68.2%) of 85 patients receiving POV for CDI. Risk factors for systemic exposure to VAN following administration of POV included ICU admission; VAN dosages > 500 mg/day; administration ≥ 10 days or as retention enemas; and the presence of severe CDI, renal dysfunction, or inflammatory conditions of the GI tract. Unique to our study, we identified ICU admission and the concomitant use of VAN retention enemas to be significant risk factors for systemic exposure to VAN.

Key Words vancomycin retention enemas, intestinal absorption, biologic availability.

(Pharmacotherapy 2015;35(2):119–126) doi: 10.1002/phar.1538

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		• Alternate if above agents are unavailable: metronidazole, 500 mg 3 times per day by mouth for 10 days	Weak/High
Initial episode, severe[b]	Leukocytosis with a white blood cell count of ≥15000 cells/mL or a serum creatinine level >1.5 mg/dL	• VAN, 125 mg 4 times per day by mouth for 10 days, OR	Strong/High
		• FDX 200 mg given twice daily for 10 days	Strong/High
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First recurrence	…	• VAN 125 mg given 4 times daily for 10 days if metronidazole was used for the initial episode, OR	Weak/Low
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Abbreviations: FDX, fidaxomicin; VAN, vancomycin.

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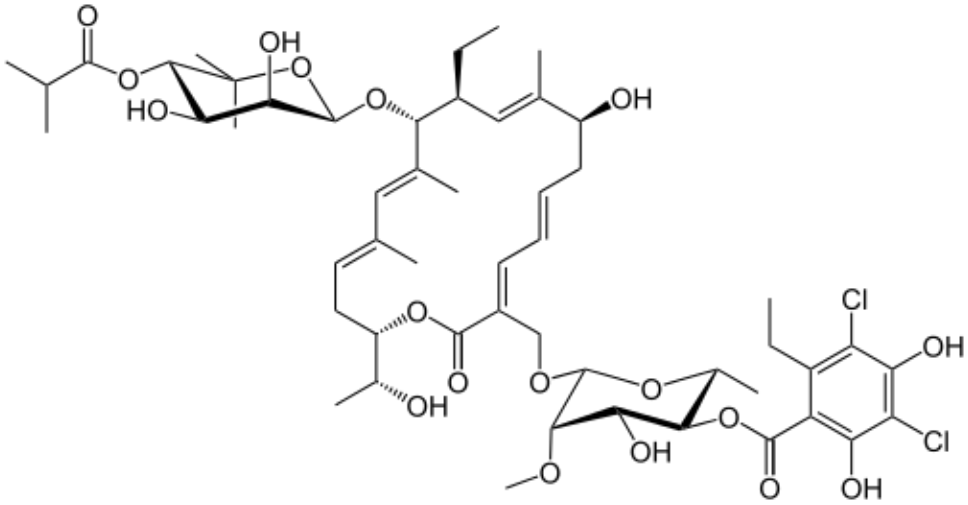
Fidaxomicina



- Battericida, con azione selettiva su Gram + e in particolare Clostridium difficile, e minima attività sulla flora intestinale.
- Inibitore della RNA polimerasi dei Clostridi
- Non assorbita dopo somministrazione orale.
- Posologia 200 mg ogni 12 ore per 10 giorni

Fidaxomicin versus Vancomycin for *Clostridium difficile* Infection

Thomas J. Louie, M.D., Mark A. Miller, M.D., Kathleen M. Mullane, D.O., Karl Weiss, M.D., Arnold Lentnek, M.D., Yoav Golan, M.D., Sherwood Gorbach, M.D., Pamela Sears, Ph.D., and Youe-Kong Shue, Ph.D., for the OPT-80-003 Clinical Study Group*

From the University of Calgary, Calgary, AB, Canada (T.J.L.); McGill University (M.A.M.) and the University of Montreal (K.W.) — both in Montreal; the University of Chicago, Chicago (K.M.M.); Wellstar Infectious Disease, Marietta, GA (A.L.); Tufts Medical Center, Boston (Y.G., S.G.); and Optimer Pharmaceuticals, San Diego, CA (S.G., P.S., Y.-K.S.). Address reprint requests to Dr. Louie at the Division of Infectious Diseases, Departments of Medicine and Microbiology and Infectious Diseases, University of Calgary, Foothills Hospital, 1403 29 St. NW, Calgary, AB T2N 4J8, Canada, or at thomas.louie@albertahealthservices.ca.

*Additional investigators in the OPT-80-003 Clinical Study Group are listed in the Supplementary Appendix, available at NEJM.org.

This article (10.1056/NEJMoa0910812) was updated on September 15, 2011, at NEJM.org.

N Engl J Med 2011;364:422-31.

ABSTRACT

BACKGROUND

Clostridium difficile infection is a serious diarrheal illness associated with substantial morbidity and mortality. Patients generally have a response to oral vancomycin or metronidazole; however, the rate of recurrence is high. This phase 3 clinical trial compared the efficacy and safety of fidaxomicin with those of vancomycin in treating *C. difficile* infection.

METHODS

Adults with acute symptoms of *C. difficile* infection and a positive result on a stool toxin test were eligible for study entry. We randomly assigned patients to receive fidaxomicin (200 mg twice daily) or vancomycin (125 mg four times daily) orally for 10 days. The primary end point was clinical cure (resolution of symptoms and no need for further therapy for *C. difficile* infection as of the second day after the end of the course of therapy). The secondary end points were recurrence of *C. difficile* infection (diarrhea and a positive result on a stool toxin test within 4 weeks after treatment) and global cure (i.e., cure with no recurrence).

RESULTS

A total of 629 patients were enrolled, of whom 548 (87.1%) could be evaluated for the per-protocol analysis. The rates of clinical cure with fidaxomicin were noninferior to those with vancomycin in both the modified intention-to-treat analysis (88.2% with fidaxomicin and 85.8% with vancomycin) and the per-protocol analysis (92.1% and 89.8%, respectively). Significantly fewer patients in the fidaxomicin group than in the vancomycin group had a recurrence of the infection, in both the modified

CONCLUSIONS

The rates of clinical cure after treatment with fidaxomicin were noninferior to those after treatment with vancomycin. Fidaxomicin was associated with a significantly lower rate of recurrence of *C. difficile* infection associated with non–North American Pulsed Field type 1 strains. (Funded by Optimer Pharmaceuticals; ClinicalTrials.gov number, NCT00314951.)

Table 1. Recommendations for the Treatment of *Clostridium difficile* Infection in Adults

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		• Alternate if above agents are unavailable: metronidazole, 500 mg 3 times per day by mouth for 10 days	Weak/High
Initial episode, severe[b]	Leukocytosis with a white blood cell count of ≥15000 cells/mL or a serum creatinine level >1.5 mg/dL	• VAN, 125 mg 4 times per day by mouth for 10 days, OR	Strong/High
		• FDX 200 mg given twice daily for 10 days	Strong/High
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		• FDX 200 mg given twice daily for 10 days if VAN was used for the initial episode	Weak/Moderate
Second or subsequent recurrence	…	• VAN in a tapered and pulsed regimen, OR	Weak/Low
		• VAN, 125 mg 4 times per day by mouth for 10 days followed by rifaximin 400 mg 3 times daily for 20 days, OR	Weak/Low
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		• Fecal microbiota transplantation[c]	Strong/Moderate

Abbreviations: FDX, fidaxomicin; VAN, vancomycin.

[a]All randomized trials have compared 10-day treatment courses, but some patients (particularly those treated with metronidazole) may have delayed response to treatment and clinicians should consider extending treatment duration to 14 days in those circumstances.

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[c]The opinion of the panel is that appropriate antibiotic treatments for at least 2 recurrences (ie, 3 CDI episodes) should be tried prior to offering fecal microbiota transplantation.

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Review

Treatment failure and recurrence of *Clostridium difficile* infection following treatment with vancomycin or metronidazole: a systematic review of the evidence

Konstantinos Z. Vardakas[a,d], Konstantinos A. Polyzos[a], Konstantina Patouni[a], Petros I. Rafailidis[a,d], George Samonis[b], Matthew E. Falagas[a,c,d,*]

[a] *Alfa Institute of Biomedical Sciences, Athens, Greece*
[b] *University of Crete School of Medicine, Heraklion, Greece*
[c] *Tufts University School of Medicine, Boston, MA, USA*
[d] *Department of Medicine, Henry Dunant Hospital, Athens, Greece*

ARTICLE INFO

Keywords:
Clostridium difficile
Metronidazole
Vancomycin
Randomised trial
Prospective
Retrospective
Cohort

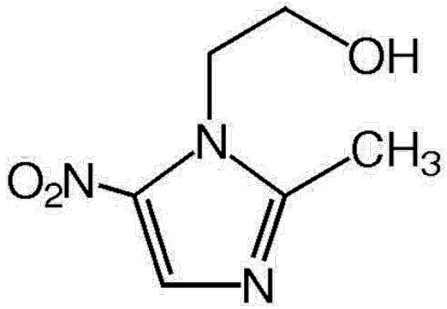
ABSTRACT

The objective of this review was to evaluate the frequency of treatment failure and recurrence of *Clostridium difficile* infection (CDI) following treatment with vancomycin or metronidazole in recently performed studies (last 10 years). Searches in PubMed and Scopus were performed by two reviewers independently. Data regarding treatment failure and recurrence following metronidazole and vancomycin treatment were extracted and analysed. In total, 39 articles (7005 patients) were selected for inclusion in the systematic review. The reported treatment failure was 22.4% with metronidazole (16 studies) and 14.2% with vancomycin (8 studies). Recurrence of CDI occurred in 27.1% of patients following metronidazole treatment (18 studies) and 24.0% of patients following vancomycin treatment (8 studies). Mean treatment failure and recurrence in the selected studies was 22.3% (24 studies) and 22.1% (37 studies). The reported outcomes depended on the study design (higher in prospective and retrospective cohort studies than in randomised controlled trials), geographic location of the study (higher in North America than in Europe and Asia), funding (higher in studies funded by non-profit organisations than pharmaceutical companies), mean age of the studied population (higher in older patients) and duration of follow-up (higher in studies with follow-up >1 month). In conclusion, infection with *C. difficile* is associated with 22.4% and 14.2% treatment failure and 27.1% and 24.0% recurrence after treatment with metronidazole and vancomycin, respectively. The variation in the reported outcomes amongst studies depends on the study design, location, funding, age and follow-up period.

Metronidazolo

- Forma composti citotossici accettando elettroni sul nitro gruppo
- Spettro antibatterico: batteri anaerobi (*C. difficile*) e parassiti (*T. vaginalis, E. histolytica, G. lamblia*)
- Rarissima la resistenza del *C. difficile*.
- Biodisponibilità orale 100%, distribuzione ottima (inclusi CSF, osso, ascessi, metabolismo epatico)
- Posologia: 500 mg ogni 8 ore p.o. x 10 – 14 giorni
- Se dopo 7 giorni il paziente non risponde, passare alla vancomicina
- Negli episodi fulminanti il metronidazole deve essere somministrato per e.v. 500 mg ogni 8 ore

Metronidazolo



- Tossicità:
  - Reazioni disulfiram-like
  - Disturbi G.I.
  - Sapore metallico
  - Colorazione rosso bruna delle urine
  - Vertigini e neuropatia periferica per trattamenti prolungati
- Non somministrare in gravidanza o allattamento

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Initial episode, severe[b]	Leukocytosis with a white blood cell count of ≥15000 cells/mL or a serum creatinine level >1.5 mg/dL	• VAN, 125 mg 4 times per day by mouth for 10 days, OR	Strong/High
		• FDX 200 mg given twice daily for 10 days	Strong/High
Initial episode, fulminant	Hypotension or shock, ileus, megacolon	• VAN, 500 mg 4 times per day by mouth or by nasogastric tube. If ileus, consider adding rectal instillation of VAN. Intravenously administered metronidazole (500 mg every 8 hours) should be administered together with oral or rectal VAN, particularly if ileus is present.	Strong/Moderate (oral VAN); Weak/Low (rec… Strong/Moderate (intravenous metronidazole)
First recurrence	…	• VAN 125 mg given 4 times daily for 10 days if metronidazole was used for the initial episode, OR	Weak/Low
		• Use a prolonged tapered and pulsed VAN regimen if a standard regimen was used for the initial episode (eg, 125 mg 4 times per day for 10–14 days, 2 times per day for a week, once per day for a week, and then every 2 or 3 days for 2–8 weeks), OR	Weak/Low
		• FDX 200 mg given twice daily for 10 days if VAN was used for the initial episode	Weak/Moderate
Second or subsequent recurrence	…	• VAN in a tapered and pulsed regimen, OR	Weak/Low
		• VAN, 125 mg 4 times per day by mouth for 10 days followed by rifaximin 400 mg 3 times daily for 20 days, OR	Weak/Low
		• FDX 200 mg given twice daily for 10 days, OR	Weak/Low
		• Fecal microbiota transplantation[c]	Strong/Moderate

Abbreviations: FDX, fidaxomicin; VAN, vancomycin.

[a]All randomized trials have compared 10-day treatment courses, but some patients (particularly those treated with metronidazole) may have delayed response to treatment and clinicians should consider extending treatment duration to 14 days in those circumstances.

[b]The criteria proposed for defining severe or fulminant *Clostridium difficile* infection (CDI) are based on expert opinion. These may need to be reviewed in the future upon publication of prospectively validated severity scores for patients with CDI.

[c]The opinion of the panel is that appropriate antibiotic treatments for at least 2 recurrences (ie, 3 CDI episodes) should be tried prior to offering fecal microbiota transplantation.

Indications for surgical consultation in the management of CDI

Any one of the following:
▪ Hypotension with or without required use of vasopressors
▪ Fever ≥38.5°C
▪ Ileus or significant abdominal distention
▪ Peritonitis or significant abdominal tenderness
▪ Mental status changes
▪ WBC ≥20,000 cells/mL
▪ Serum lactate levels >2.2 mmol/L
▪ Admission to intensive care unit for CDI
▪ End organ failure (mechanical ventilation, renal failure, etc.)
▪ Failure to improve after three to five days of maximal medical therapy

CDI: *Clostridioides* (formerly *Clostridium*) *difficile* infection; WBC: white blood cell.

Fecal microbiota transplantation for severe and fulminant CDI

Recommendation

11. We suggest FMT be considered for patients with severe and fulminant CDI refractory to antibiotic therapy, in particular, when patients are deemed poor surgical candidates (strong recommendation, low quality of evidence).

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Table 1. Recommendations for the Treatment of *Clostridium difficile* Infection in Adults

Clinical Definition	Supportive Clinical Data	Recommended Treatment[a]	Strength of Recommendation/ Quality of Evidence
Initial episode, non-severe	Leukocytosis with a white blood cell count of ≤15000 cells/mL and a serum creatinine level <1.5 mg/dL	• VAN 125 mg given 4 times daily for 10 days, OR	Strong/High
		• FDX 200 mg given twice daily for 10 days	Strong/High
		• Alternate if above agents are unavailable: metronidazole, 500 mg 3 times per day by mouth for 10 days	Weak/High
Initial episode, severe[b]	Leukocytosis with a white blood cell count of ≥15000 cells/mL or a serum creatinine level >1.5 mg/dL	• VAN, 125 mg 4 times per day by mouth for 10 days, OR	Strong/High
		• FDX 200 mg given twice daily for 10 days	Strong/High
Initial episode, fulminant	Hypotension or shock, ileus, megacolon	• VAN, 500 mg 4 times per day by mouth or by nasogastric tube. If ileus, consider adding rectal instillation of VAN. Intravenously administered metronidazole (500 mg every 8 hours) should be administered together with oral or rectal VAN, particularly if ileus is present.	Strong/Moderate (oral VAN); Weak/Low (rectal VAN); Strong/Moderate (intravenous metronidazole)
First recurrence	…	• VAN 125 mg given 4 times daily for 10 days if metronidazole was used for the initial episode, OR	Weak/Low
		• Use a prolonged tapered and pulsed VAN regimen if a standard regimen was used for the initial episode (eg, 125 mg 4 times per day for 10–14 days, 2 times per day for a week, once per day for a week, and then every 2 or 3 days for 2–8 weeks), OR	Weak/Low
		• FDX 200 mg given twice daily for 10 days if VAN was used for the initial episode	Weak/Moderate
Second or subsequent recurrence	…	• VAN in a tapered and pulsed regimen, OR	Weak/Low
		• VAN, 125 mg 4 times per day by mouth for 10 days followed by rifaximin 400 mg 3 times daily for 20 days, OR	Weak/Low
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[c]The opinion of the panel is that appropriate antibiotic treatments for at least 2 recurrences (ie, 3 CDI episodes) should be tried prior to offering fecal microbiota transplantation.

PREVENTION OF CDI RECURRENCE

FMT for recurrent CDI

Recommendations

14. We recommend patients experiencing their second or further recurrence of CDI be treated with FMT to prevent further recurrences (strong recommendation, moderate quality of evidence).
15. We recommend FMT be delivered through colonoscopy (strong recommendation, moderate quality of evidence) or capsules (strong recommendation, moderate quality of evidence) for treatment of rCDI; we suggest delivery by enema if other methods are unavailable (conditional recommendation, low quality of evidence).
16. We suggest repeat FMT for patients experiencing a recurrence of CDI within 8 weeks of an initial FMT (conditional recommendation, very low quality of evidence).

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Research

Preliminary Communication

Oral, Capsulized, Frozen Fecal Microbiota Transplantation for Relapsing *Clostridium difficile* Infection

Ilan Youngster, MD, MMSc; George H. Russell, MD, MSc; Christina Pindar, BA; Tomer Ziv-Baran, PhD; Jenny Sauk, MD; Elizabeth L. Hohmann, MD

Data supporting the use of fecal microbiota transplantation for recurrent CDI are increasing; however, the regulation and standardization of fecal microbiota transplantation is evolving. Studies are ongoing to develop synthetic stool for treating CDI or capsules for administrating fecal microbiota transplantation.

CONCLUSIONS

The infusion of donor feces was significantly more effective for the treatment of recurrent *C. difficile* infection than the use of vancomycin. (Funded by the Netherlands Organization for Health Research and Development and the Netherlands Organization for Scientific Research; Netherlands Trial Register number, NTR1177.)

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OPEN ACCESS

European consensus conference on faecal microbiota transplantation in clinical practice

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ABSTRACT

Faecal microbiota transplantation (FMT) is an important therapeutic option for *Clostridium difficile* infection. Promising findings suggest that FMT may play a role also in the management of other disorders associated with the alteration of gut microbiota. Although the health community is assessing FMT with renewed interest and patients are becoming more aware, there are technical and logistical issues in establishing such a non-standardised treatment into the clinical practice with safety and proper governance. In view of this, an evidence-based recommendation is needed to drive the practical implementation of FMT. In this European Consensus Conference, 28 experts from 10 countries collaborated, in separate working groups and through an evidence-based process, to provide statements on the following key issues: FMT indications; donor selection; preparation of faecal material; clinical management and faecal delivery and basic requirements for implementing an FMT centre. Statements developed by each working group were evaluated and voted by all members, first through an electronic Delphi process, and then in a plenary consensus conference. The recommendations were released according to best available evidence, in order to act as guidance for physicians who plan to implement FMT, aiming at supporting the broad availability of the procedure, discussing other issues relevant to FMT and promoting future clinical research in the area of gut microbiota manipulation. This consensus report strongly recommends the implementation of FMT centres for the treatment of *C. difficile* infection as well as traces the guidelines of technicality, regulatory, administrative and laboratory requirements.

INTRODUCTION

Faecal microbiota transplantation (FMT) consists of the infusion of faeces from a healthy donor to the GI tract of a recipient patient, in order to treat a specific disease associated with alteration of gut microbiota. A large body of evidence, including randomised controlled trials (RCTs), systematic reviews and meta-analyses, proved clear evidence that FMT is a highly effective treatment against recurrent *Clostridium difficile* infection (rCDI).[1–7] Due to the rising prevalence, severity and mortality of this infection, the therapeutic role played by FMT is therefore important to save human lives and to decrease the economic burden on healthcare systems.[8–11] Based on these data, both the European Society for Microbiology and Infectious Disease and the American College of Gastroenterology recommend FMT as a treatment for rCDI.[12 13]

Beyond the treatment of CDI, FMT has also been investigated in other disorders associated with the alteration of gut microbiota. In particular, studies in humans include RCTs in patients with UC and metabolic syndrome (MS).[14–16]

The global interest in FMT is increasing, and both doctors and patients are increasingly aware and informed. Although the dissemination of FMT in the clinical practice is restricted by regulatory and bureaucratic issues (principally related to costs, donor programme, safety control),[17–19] the FMT practice is booming, ranging from highly organised stool banking programmes to individual treatments with patient-identified directed donors, and even to individual and harmful do-it-yourself practices. Working groups (WGs) from the USA, Austria and France released recommendations on indications and methods of FMT.[20–22] Authoritative published guidelines and recommendations have been released as expert opinions rather than evidence-based consensus reports. A rigorous and formal evidence-based process to drive the wide range of FMT practice has not been performed yet.

The aim of this evidence-based consensus report is to define indications and methodology for the use of FMT in the treatment of CDI, to discuss the suitability of FMT for indications other than CDI and to address the minimum requirements needed to implement a FMT centre. The final aim is to encourage and drive the dissemination of the procedure and to promote further clinical research in the area.

METHODS

Consensus development process

The process of development of the consensus conference, aimed at drawing up evidence-based recommendations for the use of FMT in clinical practice, included the following steps: selection of

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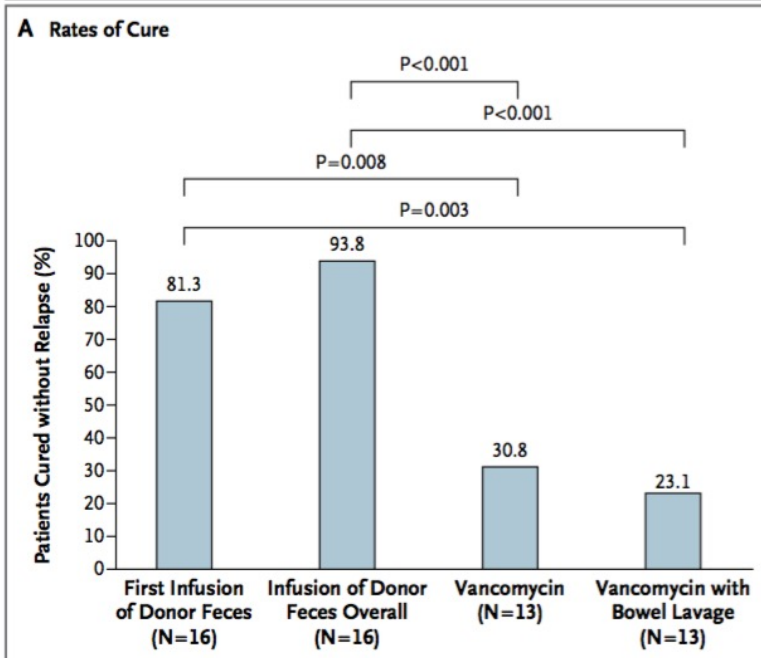

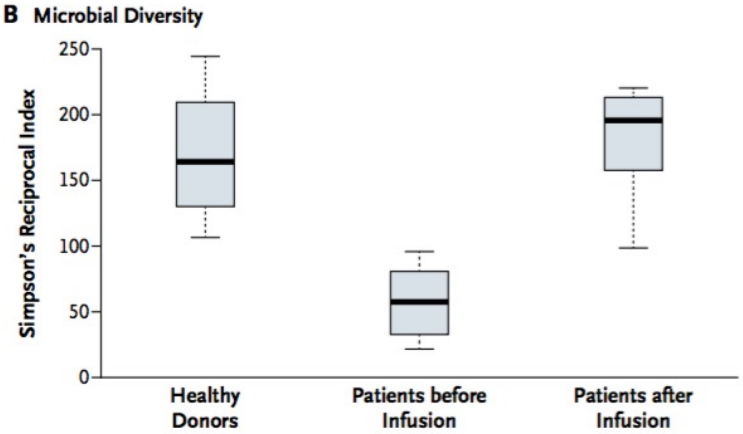

Figure 3. Rates of Cure and Changes to the Microbiota after Fecal Microbial Transplantation for Recurrent *Clostridium difficile* Infection.

Among patients with recurrent *C. difficile* infection, the rate of cure without relapse was higher among those who received an infusion of donor feces than among those who received vancomycin with or without bowel lavage (Panel A). Fecal microbial diversity in recipients before and after the infusion of donor feces is compared with the diversity in healthy donors (Panel B). Microbial diversity is expressed by Simpson's Reciprocal Index. The index ranges from 1 to 250, with higher values indicating more diversity. The box-and-whisker plots indicate interquartile ranges (boxes), medians (dark horizontal lines in the boxes), and highest and lowest values (whiskers above and below the boxes). Data are from van Nood et al.[71]

The NEW ENGLAND JOURNAL of MEDICINE

BRIEF REPORT

Drug-Resistant *E. coli* Bacteremia Transmitted by Fecal Microbiota Transplant

Zachariah DeFilipp, M.D., Patricia P. Bloom, M.D., Mariam Torres Soto, M.A., Michael K. Mansour, M.D., Ph.D., Mohamad R.A. Sater, Ph.D., Miriam H. Huntley, Ph.D., Sarah Turbett, M.D., Raymond T. Chung, M.D., Yi-Bin Chen, M.D., and Elizabeth L. Hohmann, M.D.

SUMMARY

Fecal microbiota transplantation (FMT) is an emerging therapy for recurrent or refractory *Clostridioides difficile* infection and is being actively investigated for other conditions. We describe two patients in whom extended-spectrum beta-lactamase (ESBL)–producing *Escherichia coli* bacteremia occurred after they had undergone FMT in two independent clinical trials; both cases were linked to the same stool donor by means of genomic sequencing. One of the patients died. Enhanced donor screening to limit the transmission of microorganisms that could lead to adverse infectious events and continued vigilance to define the benefits and risks of FMT across different patient populations are warranted.

OTHER PREVENTION STRATEGIES

Suppressive and prophylactic vancomycin

Recommendations

17. For patients with rCDI who are not candidates for FMT, who relapsed after FMT, or who require ongoing or frequent courses of antibiotics, long-term suppressive oral vancomycin may be used to prevent further recurrences (conditional recommendation, very low quality of evidence).
18. Oral vancomycin prophylaxis (OVP) may be considered during subsequent systemic antibiotic use in patients with a history of CDI who are at high risk of recurrence to prevent further recurrence (conditional recommendation, low quality of evidence).

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Clinical Infectious Diseases

BRIEF REPORT

Efficacy of Oral Vancomycin in Preventing Recurrent *Clostridium difficile* Infection in Patients Treated With Systemic Antimicrobial Agents

Nicholas W. Van Hise,[1] Alex M. Bryant,[2] Erin K. Hennessey,[2,4] Andrew J. Crannage,[2,4] Jad A. Khoury,[3] and Farrin A. Manian[5]

[1]Department of Pharmacy, Edward-Elmhurst Hospitals, Naperville, Illinois; Departments of [2]Pharmacy, and [3]Medicine, Mercy Hospital St Louis, and [4]St Louis College of Pharmacy, Missouri; and [5]Department of Medicine, Massachusetts General Hospital, Harvard Medical School, Boston

(See the Editorial Commentary by Johnson on pages 654–5.)

We compared rates of recurrent *Clostridium difficile* infection in patients receiving or not receiving oral vancomycin prophylaxis with systemic antimicrobial therapy. The incidence of *C. difficile* infection was significantly lower in patients receiving prophylaxis (4.2% vs 26.6% in those without prophylaxis; odds ratio, 0.12; 95% confidence interval, .04–.4; $P < .001$).

Keywords. prophylaxis; *Clostridium difficile*; vancomycin; antimicrobial agents.

From The Medical Letter on Drugs and Therapeutics

Bezlotoxumab (Zinplava) for Prevention of Recurrent *Clostridium Difficile* Infection

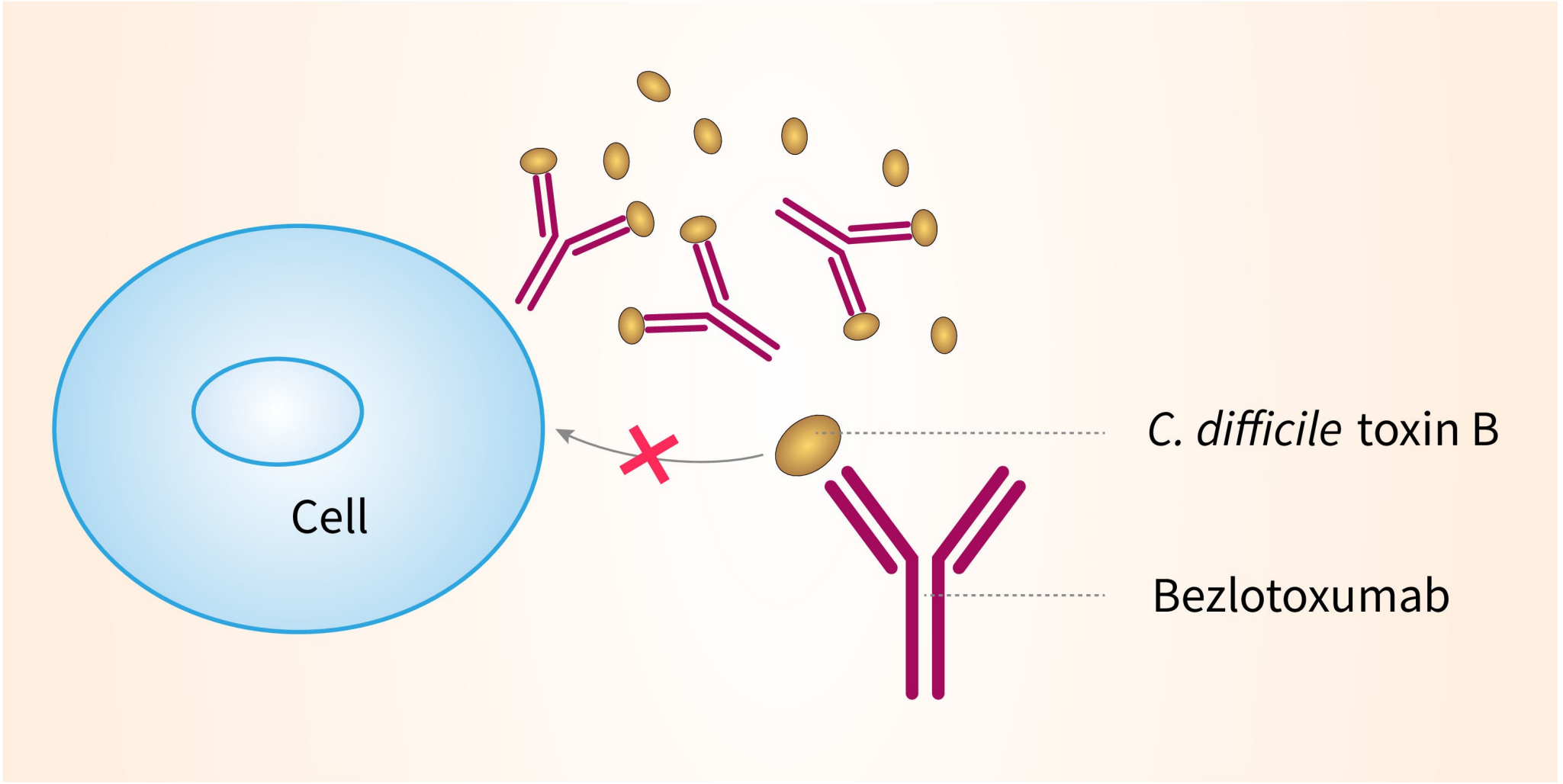
JAMA August 15, 2017 Volume 318, Number 7

The FDA has approved the fully human monoclonal antibody bezlotoxumab (Zinplava – Merck) for use with antibacterial drug treatment to reduce recurrence of *Clostridium difficile* infection (CDI) in adults with CDI at high risk for recurrence. It is the first drug to be approved for this indication.

Pronunciation Key

Bezlotoxumab: bez" loe tox' ue mab **Zinplava:** zin plah' va

- anticorpo monoclonale concepito per legarsi alla tossina B prodotta dal Clostridium difficile, neutralizzandone l'attività: in associazione alla terapia antibiotica per il Clostridium difficile, rappresenta un alleato in grado di consentire la prevenzione della recidiva di infezione. Il farmaco è, infatti, in grado di ridurre di circa il 40% le recidive, abbattendo del 53%7 il rischio di riospedalizzazioni correlate alla patologia.
- Approvato dall'AIFA luglio 2018


Cell
C. difficile toxin B
Bezlotoxumab

Costi del trattamento

Farmaco	Nome comm.	Posologia/die		Costo di un trattamento di 10 g
Metronidazolo	Flagyl®	500 mg x 3	20 cpr 250 mg € 2,57	€ 7,71
Vancomicina	Levovanox® Maxivanil®	125 mg x 4	4 cps 250 mg € 18,19 Polvere per infusione e.v. 500 mg € 11,23	€ 181,9 € 112,3
Fidaxomicina	Dificlir®	200 mg x 2	20 cpr 200 mg € 2.487,44	€ 2.487,44
Bezlotoxumab	Zinplava®	1000 mg x 1 somministrazione unica		€ 4.393,99

- # DIVERTICOLITE ACUTA NON COMPLICATA

- **Trattamento ambulatoriale** — possibile nei pazienti con diverticolite non complicata
- Il trattamento ambulatoriale non è raccomandato se
  - Sepsi
  - Microperforazione del diverticolo (es. poche bolle d'aria esternamente al colon o confinate alla pelvi)
  - Paziente immunocompromesso (diabete scarsamente controllato, utilizzo cronico di glucocorticoidi ad alte dosi, uso di altri immunosoppressori, infezione da HIV, deficienza di leucociti T o B)
  - Febbre elevata
  - Leucocitosi
  - Dolori addominali severi o peritonite diffusa
  - Età > 70 anni
  - Comorbidità importanti

- **DIVERTICOLITE ACUTA NON COMPLICATA**

- **Trattamento ambulatoriale** — possibile nei pazienti con diverticolite non complicata

- Criteri per il trattamento domiciliare

  - Disponibilità a consultare nuovamente il medico se la sintomatologia peggiora
  - Compliance con il piano terapeutico
  - Dolore addominale non grave
  - Temperatura corporea non molto elevata
  - Possibilità di tollerare l'assunzione orale di fluidi e cibo
  - Nessuna o minima comorbidità
  - Sistema di supporto disponibile

- **Diverticolite non complicata**
- Paziente non ospedalizzato
  - Antibiotici orali per 7– 10 g, scelta dell'antibiotico basata sul patogeno probabile, cocchi Gram – e anaerobi (in particolare E. coli e B. fragilis).
  - Ciprofloxacina (500 mg PO due volte al giorno) più metronidazolo (500 mg PO tre volte al giorno).
  - Levofloxacina (750 mg PO una volta al giorno) più metronidazolo (500 mg PO tre volte al giorno).
  - Trimetoprim/sulfametossazolo (160/800 mg PO due volte al giorno) più metronidazolo (500 mg PO tre volte al giorno).
  - Amoxicillina-clavulanato (875/125 mg due volte al giorno) è un'alternativa.
  - Per pazienti che non tollerano metronidazolo e beta lattamici la moxifloxacina ha un buono spettro contro G- e anaerobi.
  - Valutare la sensibilità locale agli antibiotici!
- Paziente ospedalizzato
  - terapia empirica con antibiotici ad ampio spettro e.v. con attività contro cocchi G- e anaerobi, fino all'arrivo dei risultati del laboratorio da coltura di ascesso ottenuto per aspirazione percutanea o drenaggio chirurgico.
  - Rivalutare la terapia quando arriva l'antibiogramma. Se nella coltura cresce più di un organismo probabile infezione polimicrobica con anaerobi; anche se questi non vengono isolati in coltura, continuare con la copertura per gli anaerobi.

- **Raccomandazioni dietetiche**
  I pazienti ambulatoriali devono essere istruiti a consumare solo liquidi chiari. Il miglioramento clinico dovrebbe essere evidente dopo due o tre giorni, dopo di che la dieta può essere lentamente modificata. I pazienti che richiedono il ricovero possono essere trattati con liquidi chiari o completo riposo intestinale e idratazione per via endovenosa, a seconda della gravità dei sintomi.

- **Raccomandazioni dietetiche**
  Fibre - Il ruolo della terapia dietetica nella prevenzione delle recidive non è stato stabilito in studi clinici controllati randomizzati ben disegnati con follow-up a lungo termine. Tuttavia, i pazienti dovrebbero essere generalmente consigliati di consumare una dieta ricca di fibre una volta che la fase acuta è risolta. Questa raccomandazione si basa soprattutto su studi non controllati, che hanno suggerito che la supplementazione di fibre a lungo termine può ridurre l'incidenza di recidive.
  Semi e noci – Ai pazienti con malattia diverticolare si è storicamente consigliato di evitare semi, mais e noci per la preoccupazione che i frammenti non digeriti possano rimanere incastrati all'interno di un diverticolo, inducendo in tal modo un episodio di diverticolite. Non c'è nessuna prova a questo proposito

Diarrea del viaggiatore

Pathogens causing travelers' diarrhea

Bacteria
Enterotoxigenic Escherichia coli
Enteroaggregative E. coli
Campylobacter jejuni
Salmonella species
Shigella species
Clostridium difficile
Vibrio parahaemolyticus (V. cholerae less common)
Aeromonas hydrophilia
Plesiomonas shigelloides
Yersinia enterocolitica
Viruses
Rotavirus
Enteric adenovirus
Parasites
Giardia lamblia
Cryptosporidium parvum
Cyclospora cayetanensis
Microsporidia
Isospora belli
Entamoeba histolytica (not common)

Diarrea del viaggiatore

- TRATTAMENTO
  - Idratazione
  - Antibiotici
  - Antidiarroici
  - La maggior parte dei casi risolvono da soli entro tre-cinque giorni di trattamento con la sola idratazione. La terapia antimicrobica accorcia la durata della malattia di circa un giorno e gli antidiarroici possono limitare i sintomi.
  - L'idratazione è il trattamento più importante in quanto il rischio più significativo è l'ipovolemia. I pazienti con diarrea lieve possono alternare sorsi di liquidi che contengono sale e fluidi che contengono zucchero (brodo, succo di frutta..)

Diarrea del viaggiatore

- TRATTAMENTO
  - Diarrea grave: soluzione di reidratazione orale, che fornisce elettroliti nelle concentrazioni adeguate e necessarie. L'intestino rimane in grado di assorbire l'acqua se sono presenti il glucosio e il sale.
    I pacchetti di soluzione di reidratazione orale sono disponibili nelle farmacie della maggior parte dei paesi, possono essere miscelati con acqua potabile. In alternativa, mezzo cucchiaino di sale, 1/2 cucchiaino di bicarbonato di sodio, e 4 cucchiai di zucchero in un litro di acqua. Le soluzioni come il Gatorade non sono equivalenti. L'utilizzo di fluidi è il fattore critico.
  - I pazienti possono essere inconsapevoli di quanto liquido stanno perdendo dall'intestino.

Oral agents for self-treatment of travelers' diarrhea in adults

Agent	Dose	Duration	Comment
Azithromycin	1000 mg once	Single dose*	▪ Preferred for dysentery or febrile diarrhea, travelers from Southeast Asia, and pregnant women ▪ The 1000 mg dose may be associated with nausea
	500 mg once daily	Three-day course	
Levofloxacin	500 mg once daily	Single dose* or three-day course	▪ Fluoroquinolones are associated with multiple adverse events
Ciprofloxacin	750 mg once	Single dose*	
	500 mg twice daily	Three-day course	
Ofloxacin	400 mg once daily	Single dose* or three-day course	
Rifaximin	200 mg three times daily	Three-day course	▪ Not for use with dysentery or febrile diarrhea
Rifamycin	Two (194 mg) tablets twice daily	Three-day course	

* If symptoms have not resolved after 24 hours, the regimen can be extended to complete a three-day course (using the dosing listed for the three-day course).

Riddle MS, Connor BA, Beeching NJ, et al. Guidelines for the prevention and treatment of travelers' diarrhea: a graded expert panel report. J Travel Med 2017; 24:S57.

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Antibiotici Fluorochinolonici e chinolonici: Il PRAC raccomanda restrizioni dell'uso

Nuove restrizioni a seguito di una revisione su effetti indesiderati invalidanti e potenzialmente di lunga durata

Il Comitato di Valutazione dei Rischi per la Farmacovigilanza (PRAC), ha raccomandato restrizioni dell'uso di antibiotici fluorochinoloni e chinoloni (somministrati per bocca, per iniezione o per via inalatoria) a seguito di una revisione degli effetti indesiderati potenzialmente di lunga durata e invalidanti riportati con questi medicinali. La revisione ha tenuto conto delle opinioni dei pazienti, degli operatori sanitari e degli accademici presentate durante l'audizione pubblica dell'EMA sugli antibiotici fluorochinolonici e chinolonici a giugno 2018.

Molto raramente, i pazienti trattati con antibiotici fluorochinoloni e chinoloni, hanno subito effetti indesiderati di lunga durata e invalidanti, la maggior parte dei quali interessavano principalmente muscoli, tendini, ossa e sistema nervoso.

In seguito alla valutazione di questi effetti indesiderati, il PRAC ha raccomandato di ritirare dal commercio alcuni farmaci, compresi tutti quelli che contengono un particolare antibiotico chinolonico. Questo perché sono autorizzati solo per infezioni che non devono essere più trattate con questa classe di antibiotici.

Il PRAC ha raccomandato che i restanti antibiotici fluorochinolonici debbano:

- **non** essere usati
  - per trattare infezioni non gravi o che potrebbero migliorare senza trattamento (come infezioni alla gola);
  - per prevenire la diarrea del viaggiatore o le infezioni ricorrenti del tratto urinario inferiore (infezioni delle urine che non si estendono oltre la vescica);
  - per trattare pazienti che hanno avuto in precedenza gravi effetti collaterali con un antibiotico fluorochinolonico o chinolonico;
  - per il trattamento di infezioni lievi o moderatamente gravi a meno che altri medicinali antibatterici comunemente raccomandati per queste infezioni non possano essere usati;

- Antidarroici come la loperamide (Imodium) sono spesso utilizzati in combinazione con antibiotici per ridurre la frequenza delle scariche; non trattano la causa della diarrea. Una meta-analisi di 12 studi del 2008 suggerisce che loperamide combinato con la terapia antibiotica è utile nella diarrea del viaggiatore.
  Secondo alcuni studi questi farmaci possono prolungare alcuni tipi di dissenteria (ad esempio, Shigella), ma la maggior parte delle ricerche suggeriscono che possono essere utilizzati con sicurezza purché combinati con la terapia antibiotica (cautela nell'uso di questi farmaci nei casi di diarrea ematica).
- La loperamide non va usata nei bambini al disotto dei 6 anni.
- Se disponibile, racecadotril (Tiorfix, capsule da 100 mg 3 x die), un inibitore encefalinasi, può essere un' aggiunta efficace. A differenza della loperamide, che riduce la motilità intestinale, ha una azione antisecretoria.

  Gli antidiarroici devono essere interrotti se il dolore addominale o altri sintomi peggiorano o se la diarrea continua ad essere intrattabile dopo due giorni.