

CDI and CRE in LTC: An Alphabet Soup of Gut Bacteria

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Speaker Disclosures

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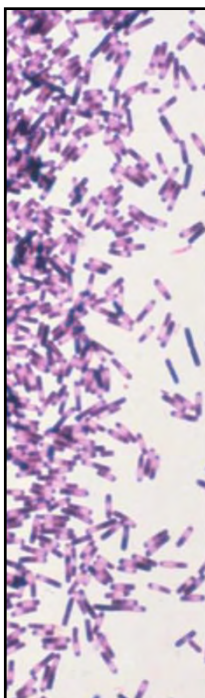
The opinions presented herein are my own and do not represent those of the Veterans Affairs system or the federal government.



Learning Objectives


By the end of the session, participants will be able to:

- Articulate risk factors for developing *C. difficile* infection
- Describe infection control interventions to reduce the risk of acquiring *C. difficile*
- Recognize carbapenem-resistant Enterobacteriaceae (CRE) and describe infection prevention strategies for these bacteria



Pathophysiology


Clinical Disease



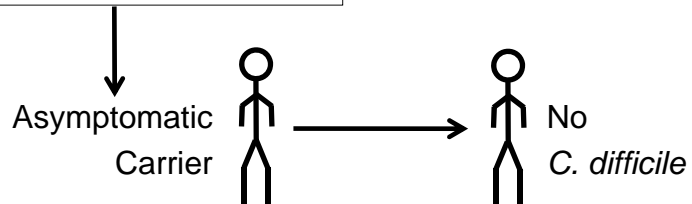
***C. difficile* Infection**
Non-severe
Severe
Severe, Complicated

Slide courtesy of Dubert Guerrero

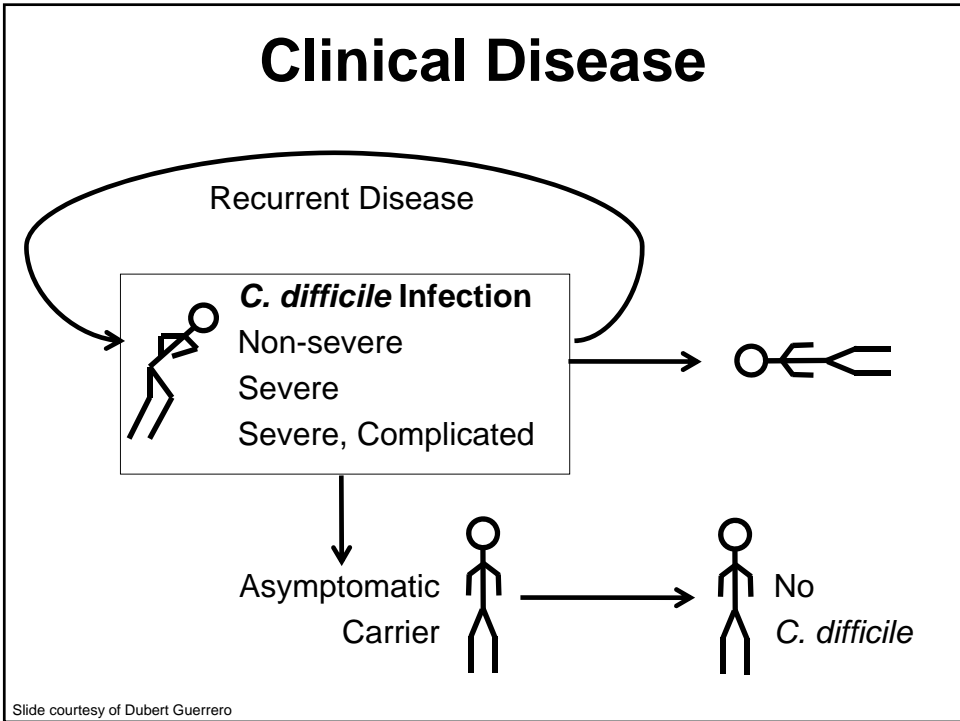
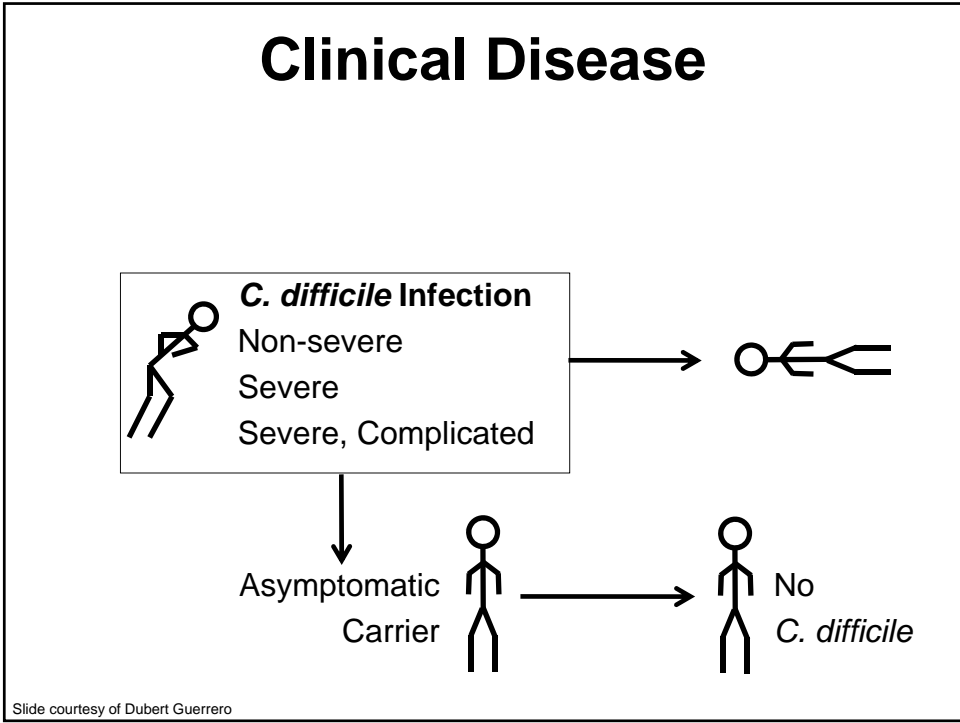
Clinical Disease

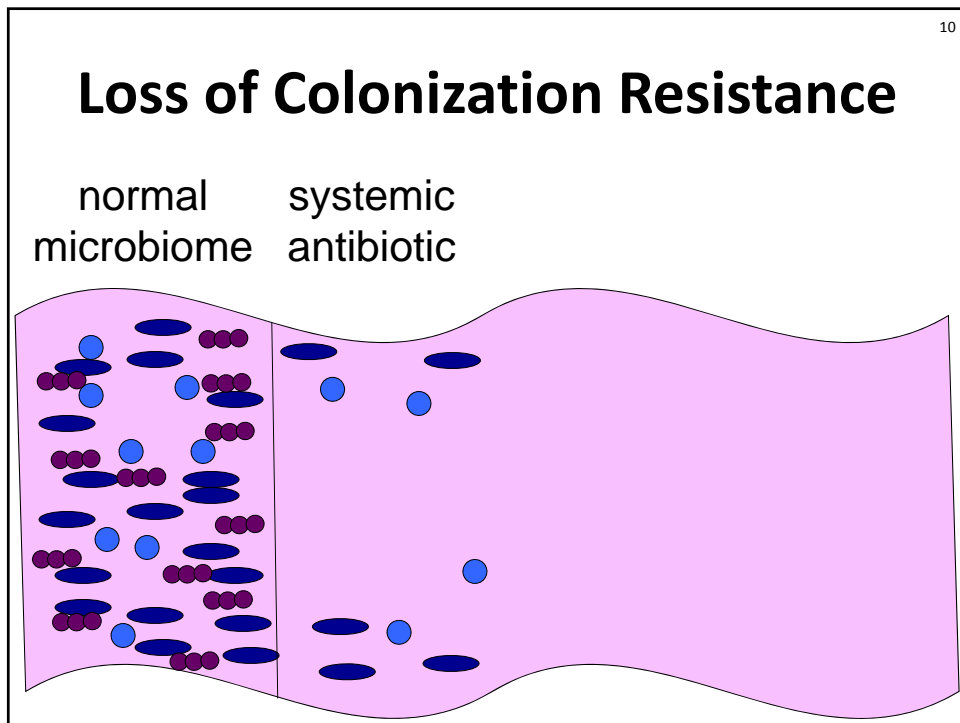
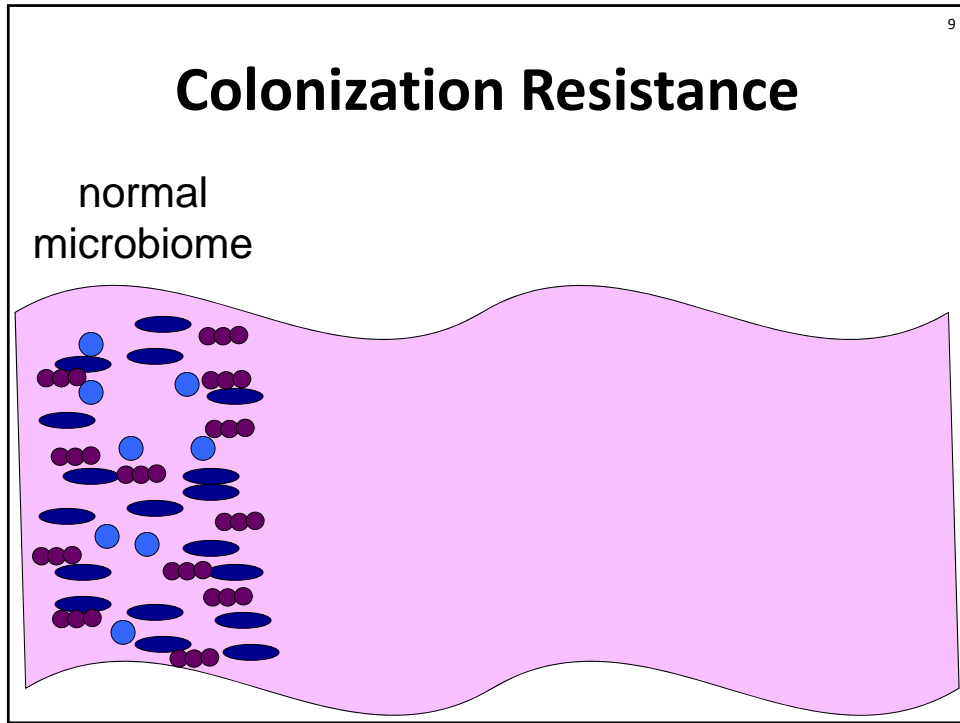


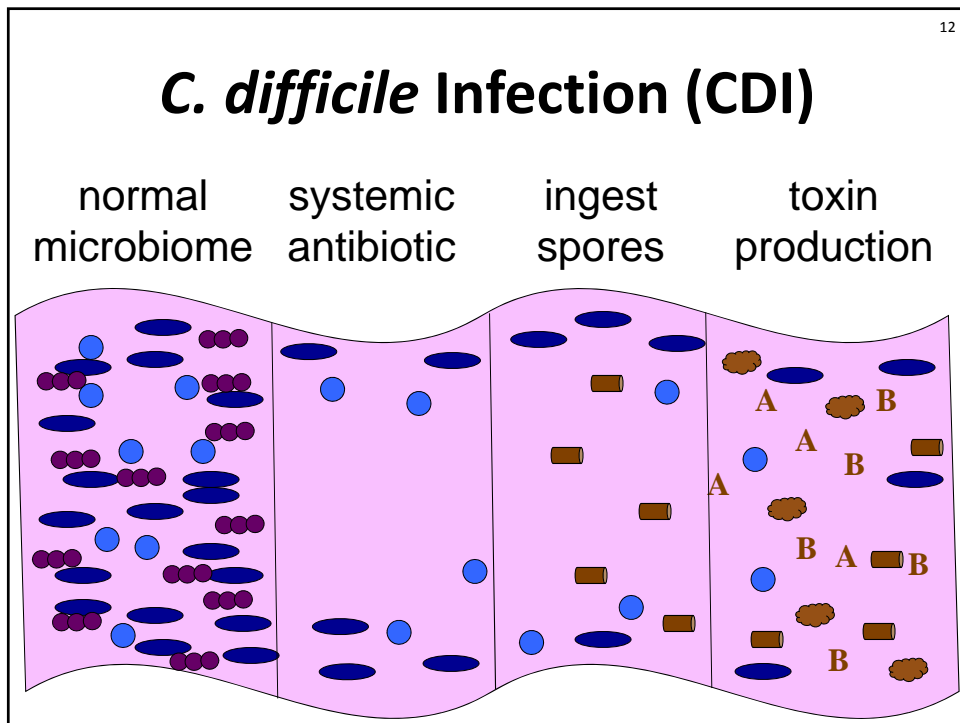
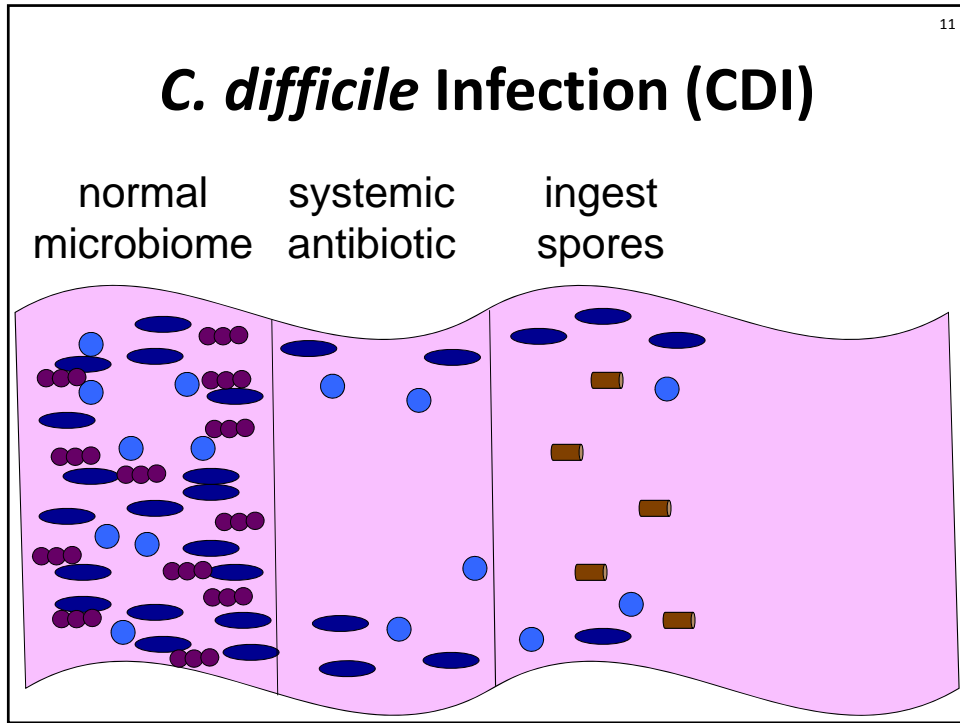
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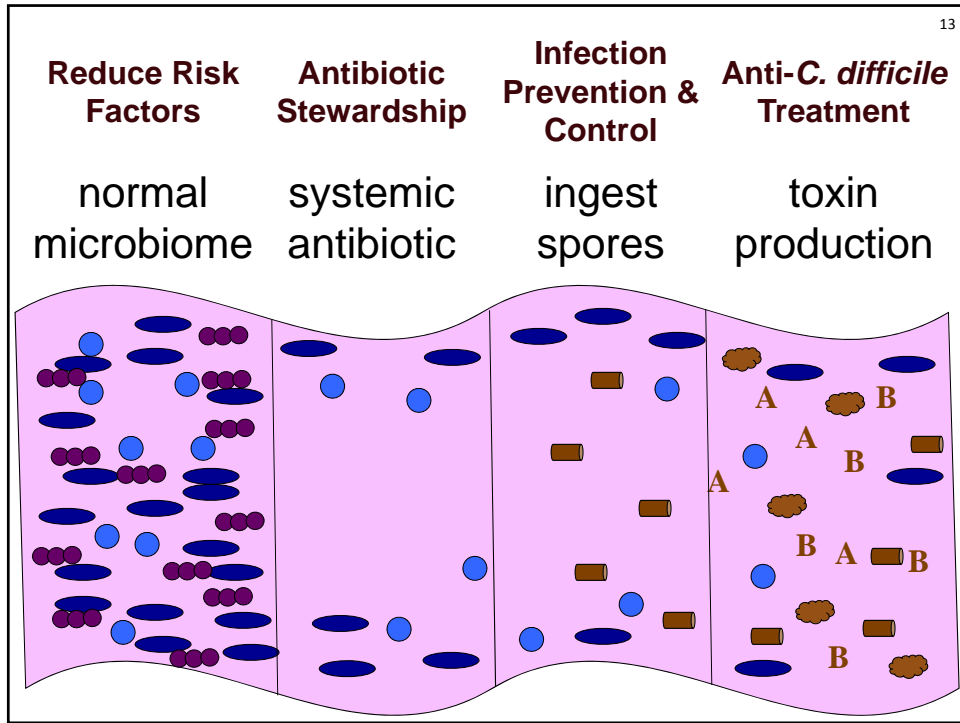


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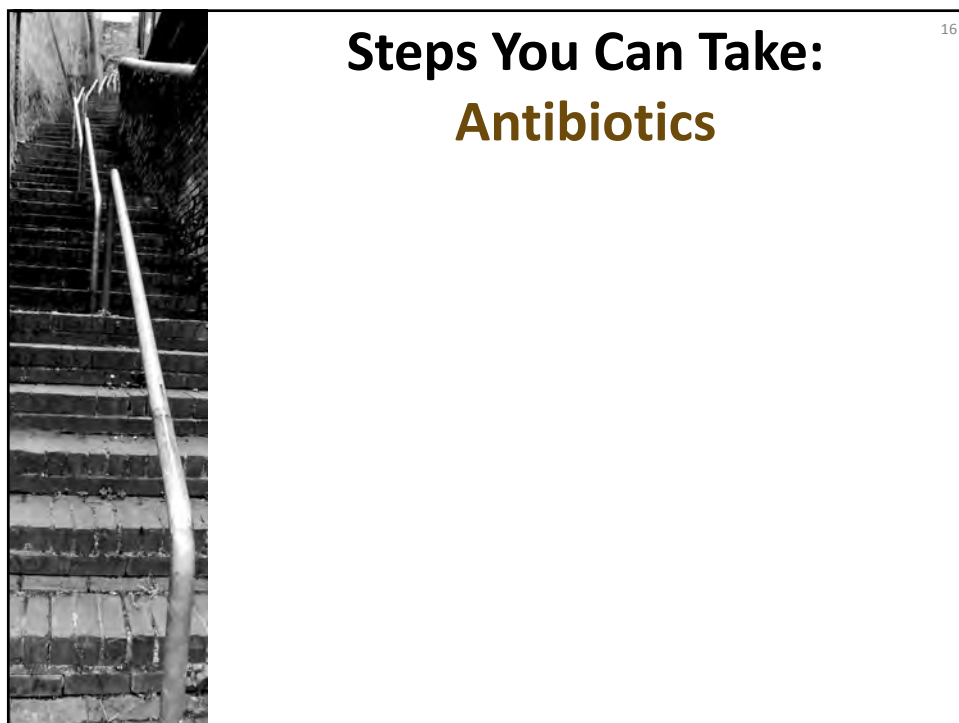
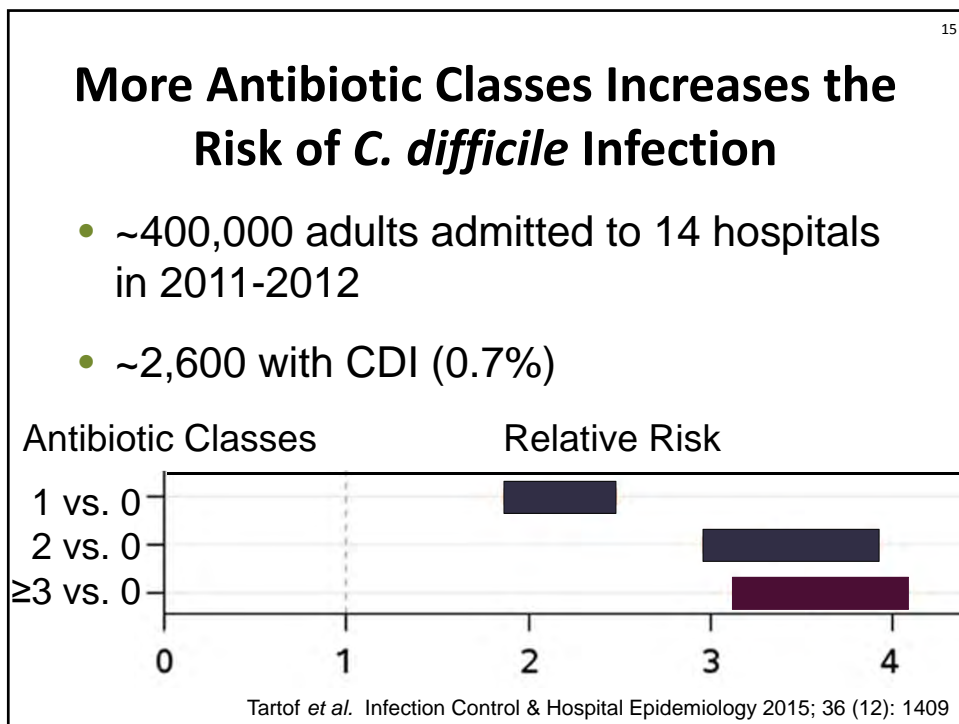





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Antibiotics
are the most
important risk
factor for
developing
C. difficile
infection.





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Steps You Can Take: Antibiotics

Avoid antibiotics when possible

Active monitoring
Promote watchful waiting

When you must use antibiotics...

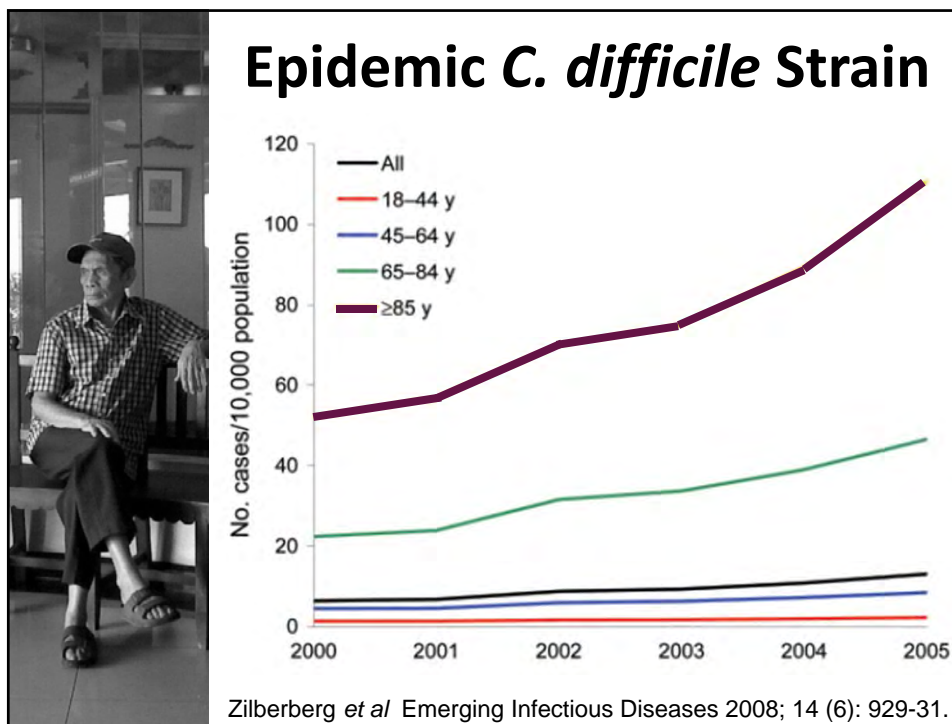
- Use shorter courses (≤ 7 days)
- Choose narrow spectrum agents
- Choose agents with less excretion into the GI tract



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Advanced Age

is the second most important risk factor for developing *C. difficile* infection.



Age-Related Vulnerability

- In 2010, >90% of deaths due to CDI were in people \geq 65 years.
- Aging leads to immune senescence.
- A poor antibody response to *C. difficile* correlates with infection.
- Older adults have a less diverse and less resilient gut microbiome.

Kelly Clin Microbiol Infect 2012; 18 Suppl 6:21-7
 Biagi *et al.* PLoS ONE 2010; 5: e10667;
 Rea *et al.* J Clin Micro 2012; 50(3):867-75
 Murphy *et al.* Death: Preliminary Data for 2010. National Vital Statistic Reports 2012.



Steps You Can Take: Advanced Age

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Steps You Can Take: Advanced Age

22



Youth


Fountain



Other Risk Factors

- Previous hospitalization
- Resident at a long-term care facility
- Underlying disease severity
- Albumin \leq 3.5 g/dL
- **Gastric acid suppression**

McDonald *et al.* MMWR **2012**; 61(9):157-62
 Dial *et al.* JAMA 2005; 294: 2989-2995
 Kyne *et al.* Age & Ageing 1999; 28: 107-113
 Dubberke *et al.* Clin Infect Dis 2007; 45: 1542-49
 Bobulsky *et al.* Clin Infect Dis. 2008;46(3):447-50



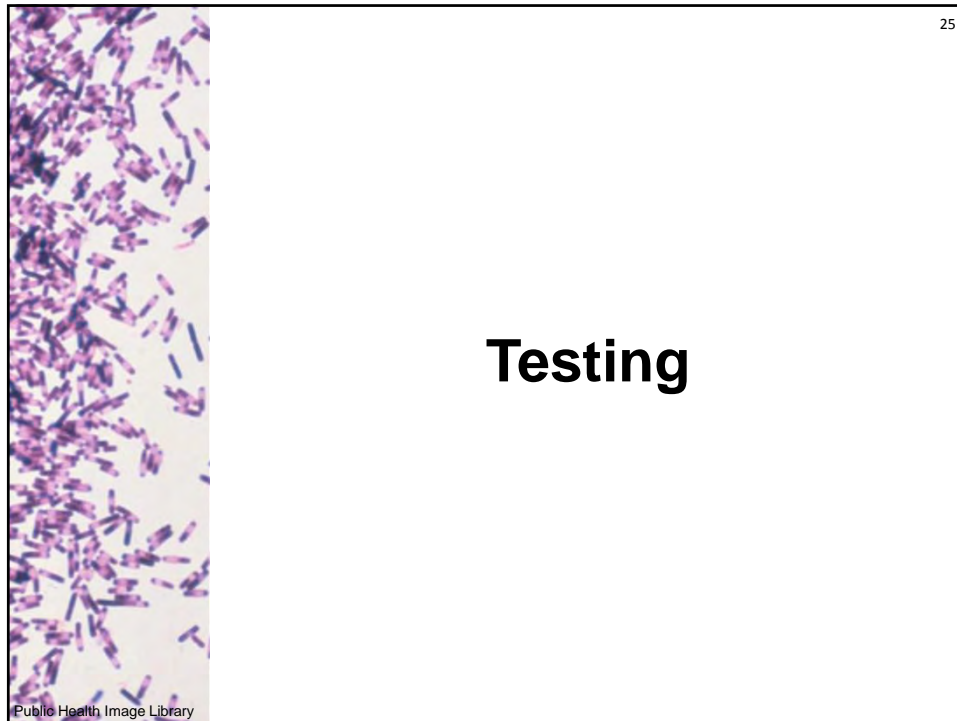
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Risk Factors for Recurrent Disease

Predictor	Adjusted Hazard Ratio
Age > 75 years	1.5 (1.1 – 2.0)
PPI* Use	1.5 (1.1 – 2.0)
Antibiotic re-exposure	1.3 (0.9 – 1.7)
Length of Stay, per day	1.003 (1.002 – 1.004)

Indication for PPI Use	No. (%) (n = 191)
No indication	101 (53%)
Age > 60 y w/ 2 other risk factors	39 (20%)
Upper GI bleeding	17 (9%)
GERD in previous 90 days	15 (8%)

*PPI = proton pump inhibitor
 McDonald *et al.* JAMA Internal Med 2015; (online 3/2/15)




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Types of Tests

Common Name (No. tests)	Type of Test	Results
GDH (4)	Enzyme Immunoassay (EIA) for Glutamate dehydrogenase (GDH)	<i>C. difficile</i> (sensitive)
EIA (9)	EIA for toxin	Toxins B & A (specific)
NAAT or PCR (11)	Nucleic Acid Amplification Test (NAAT)	Toxin B (& A); epidemic strain (sensitive)

Crobach *et al.* Clin Micro and Infection 2016 (22): S63-81

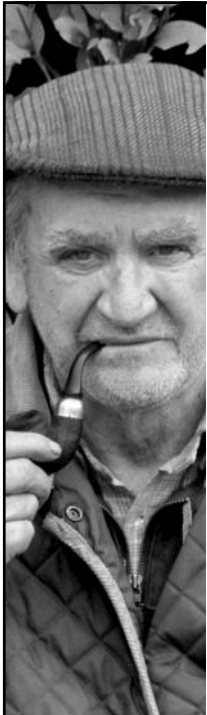


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Principles of Testing

- Enable nurses to initiate tests for *C. difficile*
- Sample should take the shape of the container, *i.e.* unformed stool
- If there is a concern for an ileus, send a rectal swab*
- No need for repeat tests
- **NO TESTS OF CURE!**

*rectal swabs can be tested using GHD EIA or NAAT

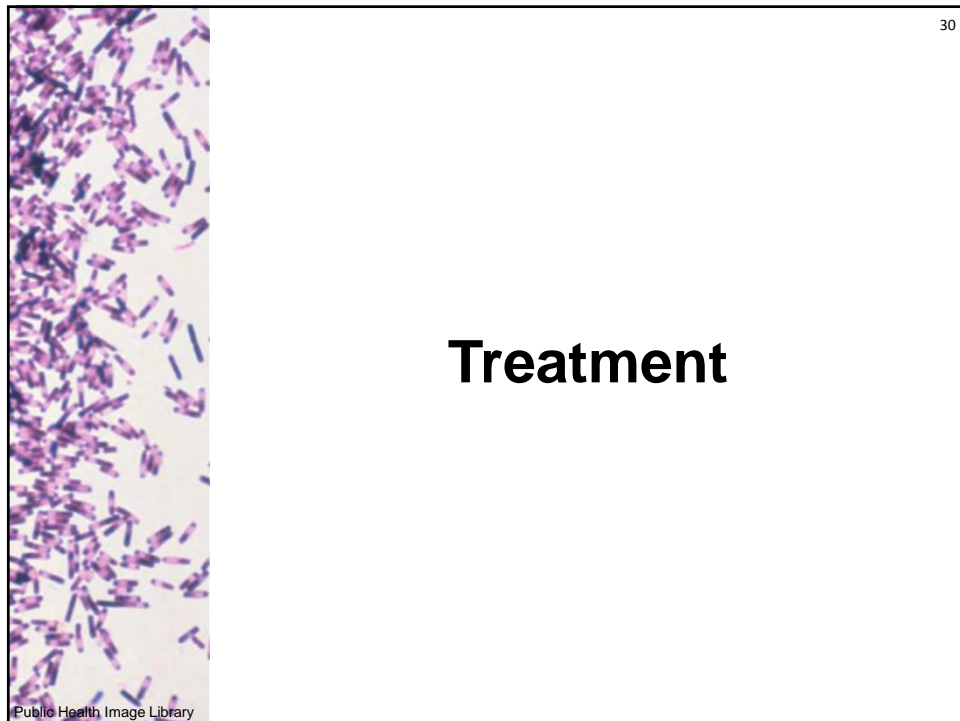
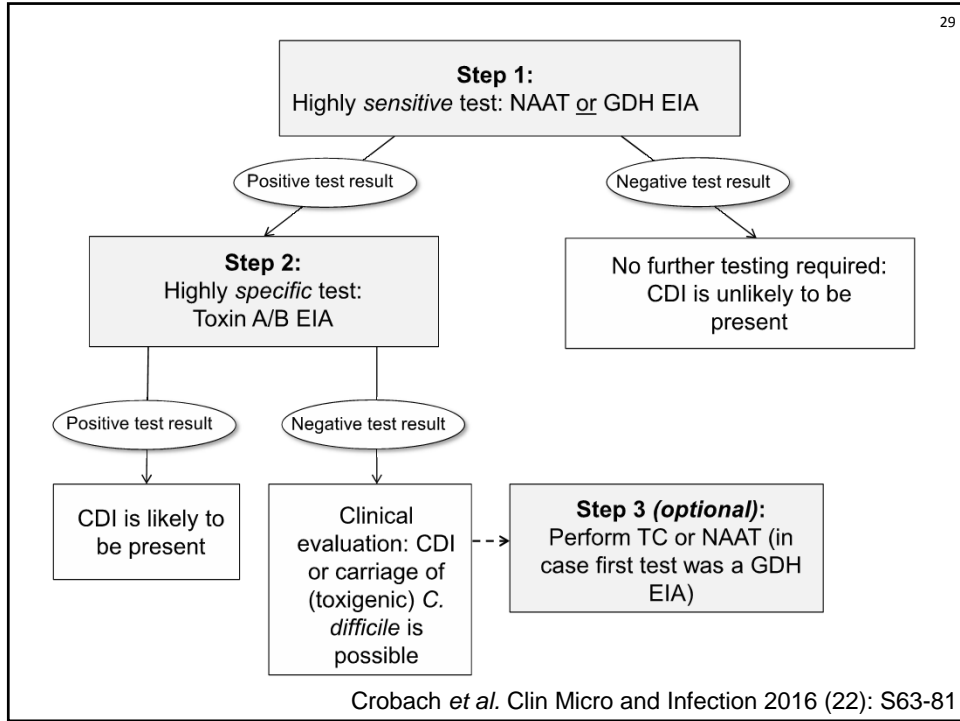


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Testing Algorithm*

- No single commercial test is sufficient as a stand-alone test
- 2-step approach
 1. High negative predictive value, *i.e.* sensitive test to rule-out
 2. High positive predictive value, *i.e.* specific test to conform

*European Society of Clinical Microbiology and Infectious Disease; Crobach *et al.* Clin Micro and Infection 2016 (22): S63-81



2010

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Treatment of Non-Severe *C. difficile* Infections

- Diarrhea; 3 or more unformed stools in <24 hours
- Stool tests positive for toxigenic *C. difficile*

Recommendation	Strength
Stop the inciting antibiotics	A-II
Oral metronidazole	A-I
If on warfarin, oral vancomycin	A-I

Cohen *et al.* *Infec Control Hosp Epi* 2010; 31:431-55

2010

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Treatment of Severe *C. difficile* Infections

- Severe infection
 - WBC >15K, Cr >1.5 x baseline

Recommendation	Strength
Oral vancomycin	B-I

- **IV metronidazole and oral vancomycin together** associated with reduced mortality (16%) compared to oral vancomycin alone (36%).
- Single center, retrospective study.

Cohen *et al.* *Infec Control Hosp Epi* 2010; 31:431-55
Rokas *et al.* *CID* 2015; 61: 934-41

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Vancomycin vs. Metronidazole

- Retrospective cohort study of ~47,000 Veterans with *C. diff* infection (2005 – 2012)
- Of those, ~4% treated with oral vancomycin
- **Matched** these to those treated with metronidazole, stratified by disease severity
- No difference in rate of recurrence

Stevens *et al.* JAMA Int Med 2017.02.06 on-line

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For Severe CDI Vancomycin Reduces Mortality

All-Cause 30-day Mortality

Severity	Overall (%)	Vancomycin (%)	Metronidazole (%)
Mild to Moderate (n=5542)	~6.5	~5.5	~6.5
Severe (n=3130)	~18.5	~15	~20

Stevens *et al.* JAMA Int Med 2017.02.06 on-line

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Treatment of Severe *C. difficile* Infections

- Severe infection
 - WBC >15K, Cr >1.5 x baseline
- Severe & Complicated
 - Unstable, Ileus, Toxic Mega-colon

Recommendation	Strength
-Oral vancomycin (high dose) -(If ileus, consider rectal instillation) -Consider IV metronidazole	C-III
Monitor serum lactate, WBC	B-II

- Consult Surgery & Infectious Disease

Cohen *et al.* Infec Control Hosp Epi 2010; 31:431-55

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Treatment, Recurrent Disease

No tests of cure!

Cohen *et al.* Infec Control Hosp Epi 2010; 31:431-55;
Garey *et al.* J Antimicrob Chemo 2011 66(12):2850-5
Surawicz *et al.* Am J. Gastroenterology 2013; 108 :478-498

2010

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Treatment, Recurrent Disease

No tests of cure!

Recurrence	
Any	Stop the inciting antibiotics
First	Repeat metronidazole
Second	Oral vancomycin
>2ndoral vanco.....or.....

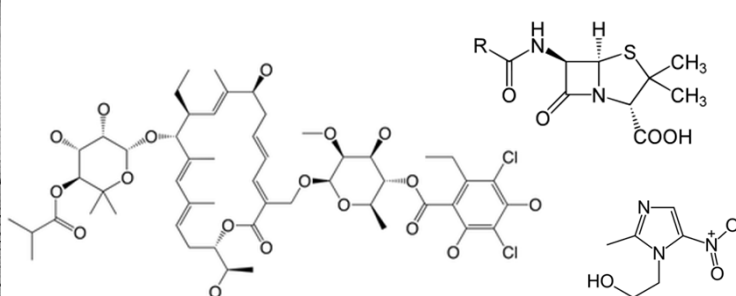
Cohen *et al.* Infec Control Hosp Epi 2010; 31:431-55;
Garey *et al.* J Antimicrob Chemo 2011 66(12):2850-5
Surawicz *et al.* Am J. Gastroenterology 2013; 108 :478-498

2010


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Fidaxomicin

- Active against *C. difficile* but spares other members of gut microbiome
- Treatment outcomes = vancomycin
- Reduces the risk of recurrent disease



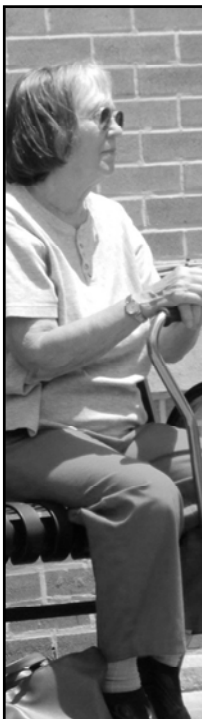
Lancaster Am J Pharm Benefits 2012 4(3):114-17



Cost Comparison

Fidaxomicin (10 days)	\$ 3300
Vancomycin (capsules; 14 days)	\$ 2000
Vancomycin (compounded)	\$ 40
Metronidazole	\$ 30

Cruz; Pharmacy & Therapeutics, 2012 37(5):278-81



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Preventing Recurrence?

- Risk of recurrent CDI ~20-30%
- ~1000-bed teaching hospital
- Retrospective cohort of people with history of CDI who went on to receive systemic antibiotics
- Of 203 patients, 71 received oral vancomycin while on systemic antibiotics
- Recurrent disease in 4% (3/71) of those on po vancomycin; 27% (35/102) of those not on po vanco

Van Hise *et al* Clin Infect Dis 2016;64:651-2

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Preventing Recurrence?

- In general, risk of recurrent CDI ~20-30%
- Retrospective cohort of people with history of CDI who went on to receive systemic antibiotics


Group	Recurrent CDI
Systemic antibiotic	27% (35/102)
Systemic antibiotic & oral vancomycin*	4% (3/71)

*PO vanco for 0-6 days *after* end of systemic antibiotic

Risk of subsequent recurrence?


Risk of VRE?

Van Hise *et al* Clin Infect Dis 2016;64:651-2



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Fecal Microbiota Transplant (FMT)




- Administration of feces from a healthy donor
- Symptom resolution in 1-2 days
- 15/16 (93%) patients cured with 1-2 treatments
- In small series of 10 adults >80 years, 8 of 10 had symptom resolution

Van Nood *et al* NEJM 2013; 368:407-15;
Rubin *et al*. 2009 JAGS;57:2386;


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Fresh or Frozen?



- Randomized non-inferiority study
- 232 adults (~73 years) with refractory CDI
- Frozen → thawed FMT works as well as fresh FMT
- FMT is a cost-effective, well-tolerated strategy
- To start your own center...
see Costello *et al.* CID 2016;62 (908-14)

Lee *et al.* JAMA 2016;315(2):142-149
 Konijeti *et al.* Clin Infect Dis 2014;58:1507-14
 Drekonja *et al.* VA ESP Project #09-009;2014




A Variety of Poop Pills

- **Frozen stool.** Capsules stored at -80° C. Each treatment made from a single donor
- Trial on 20 patients, ages 7 – 90 with refractory/ recurrent CDI
- 15 capsules a day for 2 days
- 14 responded to first treatment; 4 to second treatment for 90% cure rate

Hecker *et al.* OFID 2016; 3(2): ofwo91
 Youngster *et al.* JAMA 2014; 312(17):1772-78
 Khanna *et al.* J Inf Dis 2016 214:173-81

- **Spore capsules.** Spores generated by ethanol-treatment of stool samples
- 30 patients (median age 65 yrs) with recurrent CDI
- 26 with clinical resolution
- 15 capsules a day for 2 days



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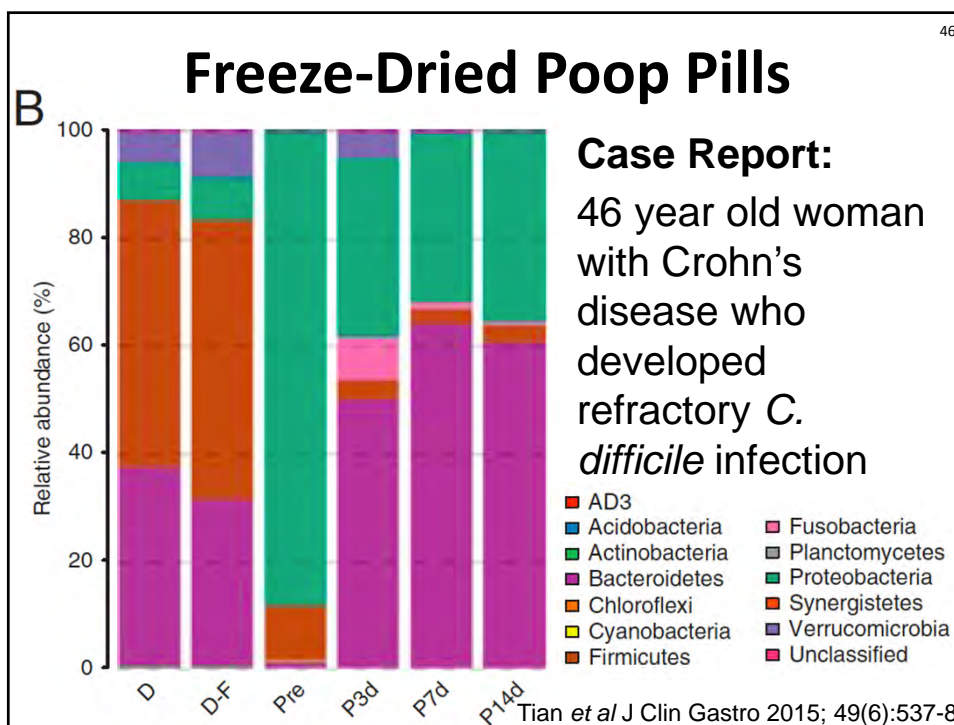
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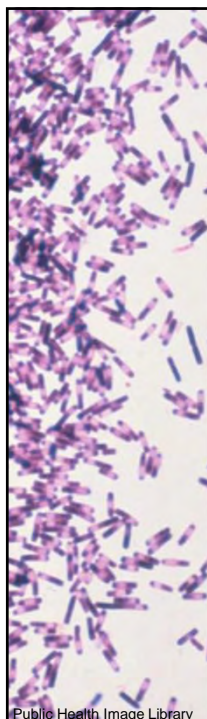
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EXPERIMENTAL





Public Health Image Library

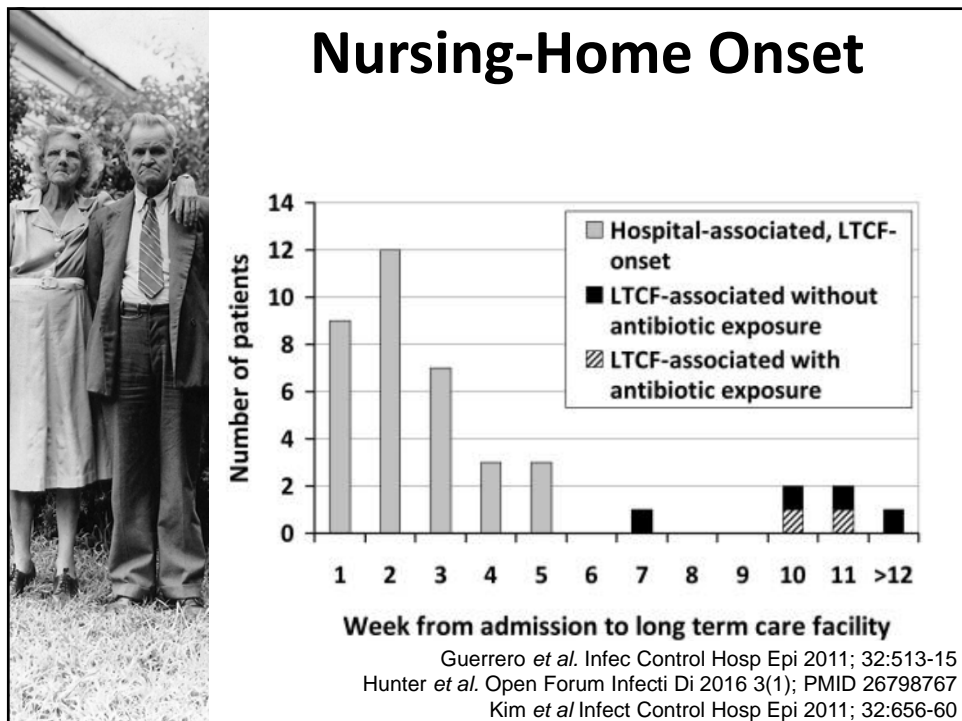
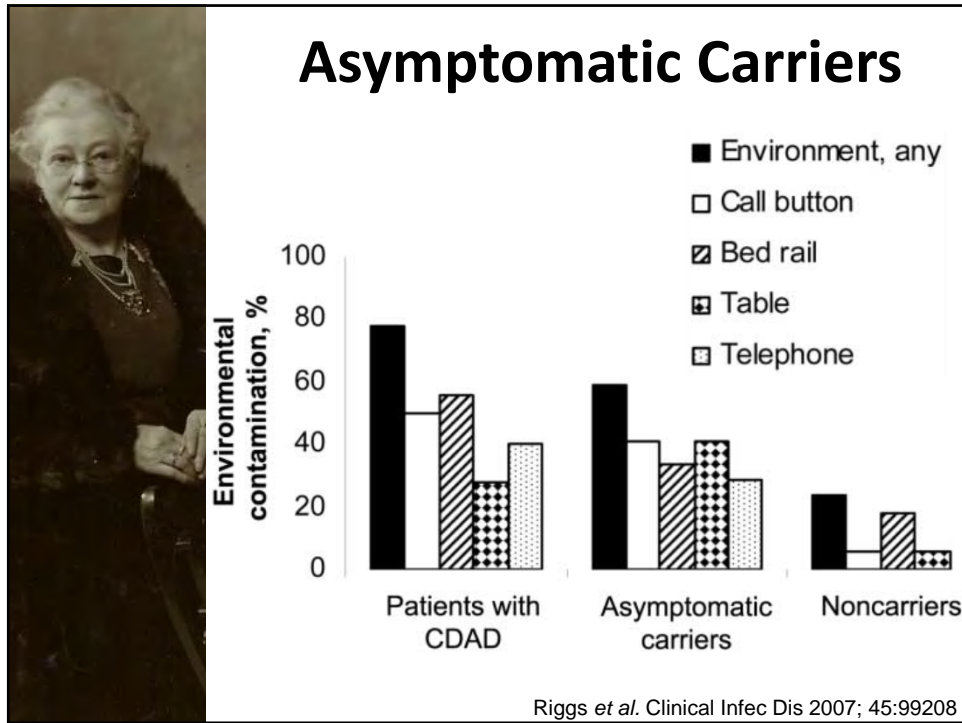
Infection Control & Prevention

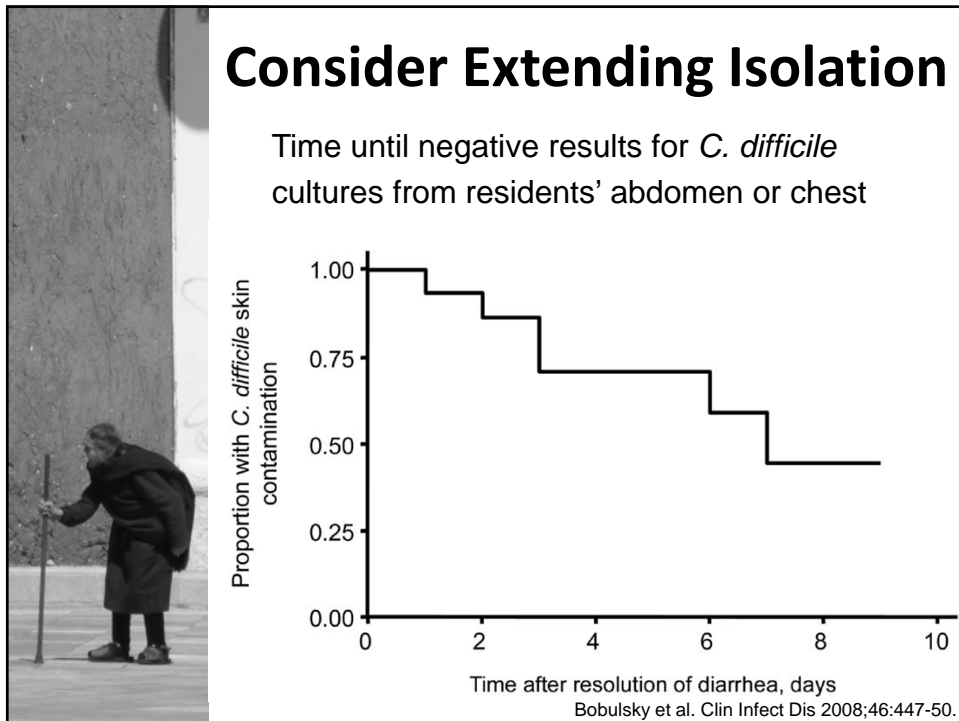
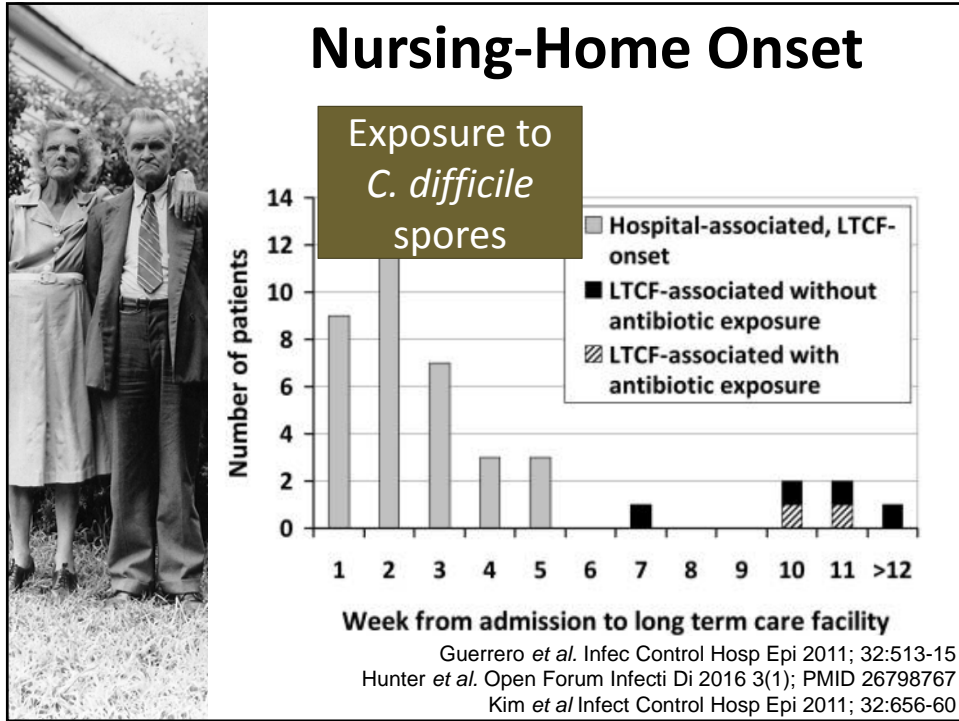


C. difficile Spores

- May be recovered **months** after left on a surface
- Difficult to kill using routine cleaning agents
- Spores are shed onto skin and into the environment

Bobulsky *et al.* Clin Infect Dis. 2008;46(3):447-50
Kim *et al.* Jnl Hosp Infection 1981; 143(1) 43-50








There's no place like home...

...but how do we clean it?

Slide Courtesy of Curtis Donskey
Sitzlar *et al* Infect Control Hosp Epi 2012; 33:534-36



Steps You Can Take:

Infection Control

Minimize Transmission by Patients/Residents

- Private rooms if know or suspect *C. difficile* infection*
- Encourage hand hygiene
- Extend isolation
- Have them use common equipment at the end of the day

*Who moves?

Cohen *et al*. *Infect Control Hosp Epi* 2010; 31:431-55
Manian *et al*. *Am J Infect Control* 2013; 41(6):537-41
http://www.cdc.gov/HAI/prevent/prevention_tools.html#ltc

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Steps You Can Take: Infection Control

Minimize Transmission by Staff

Hand hygiene with soap & water
Single use/disposable equipment
Dedicated equipment (<i>e.g.</i> , slings)
Mandatory education annually; more often for high-turnover staff

Cohen *et al.* *Infec Control Hosp Epi* 2010; 31:431-55
 Manian *et al.* *Am J Infec Control* 2013; 41(6):537-41
http://www.cdc.gov/HAI/prevent/prevention_tools.html#lhc



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Steps You Can Take: Infection Control

Minimize Transmission by Staff

Contact precautions (gown, glove)
Make equipment available at the door
Designate someone on every shift to replenish supplies
Supply disinfectant wipes with bleach

Cohen *et al.* *Infec Control Hosp Epi* 2010; 31:431-55
 Manian *et al.* *Am J Infec Control* 2013; 41(6):537-41
http://www.cdc.gov/HAI/prevent/prevention_tools.html#lhc



Steps You Can Take: Infection Control

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Minimize Environmental Reservoirs

Involve & educate housekeeping staff

Daily disinfection of high-touch surfaces

Assess adequacy of cleaning before changing to a new product

Cleaning & disinfection with sporicidal agent (*i.e.* bleach)

Cohen *et al.* *Infect Control Hosp Epi* 2010; 31:431-55

Manian *et al.* *Am J Infect Control* 2013; 41(6):537-41

http://www.cdc.gov/HAI/prevent/prevention_tools.html#lrc




Active Surveillance?

- Rectal swabs upon hospital admission to detect gene for Toxin B
- If positive, contact precautions during the hospitalization
- Of ~7600 admissions, 5% identified as carriers

Time Period	Rate of HA-CDI*
Epidemic period (8/04 – 7/07)	11.1
Pre-intervention period (7/07 – 11/13)	6.9
Intervention period (12/13 – 3/15)	3.0

*Healthcare-associated *C. difficile* infections/10,000 patient days

Longtin *et al.* *JAMA Int Med.* 2016 176(6):796-804




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Steps You Can Take: Infection Prevention

Facility-wide Measures

- Antimicrobial Stewardship Program
- Surveillance for *C. difficile* infection
- Avoid tests of cure
- Laboratory-based alert system

http://www.cdc.gov/HAI/prevent/prevention_tools.html#ltc



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Steps You Can Take: Infection Prevention

Early response to potential CDI

- Define criteria to suspect CDI
- Preemptive contact isolation
- Standing orders to test for *C. difficile* (when criteria met)

http://www.cdc.gov/HAI/prevent/prevention_tools.html#ltc



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Probiotics for Primary Prevention?

- Meta-analysis slightly favors probiotics
 - *Lactobacillus casei*, *L. acidophilus* and *L. rhamnosus* in varying combinations
 - Above given as part of clinical trials
- Double-blind RCT of *Sacromyces boulardii* stopped for futility
- FDA-approved probiotics?

Johnson *et al.*, Int J Infect Dis. 2012; 16:e786-92
 Evans & Johnson, Clin Infect Dis 2015;60 (s2)S122-8
 Bakken. Clin Infect Dis 2014;59: 858-861
 Ehrhardt *et al.* OFID on-line January 2016
 **Bakken. CID 2014;59 (858-61)

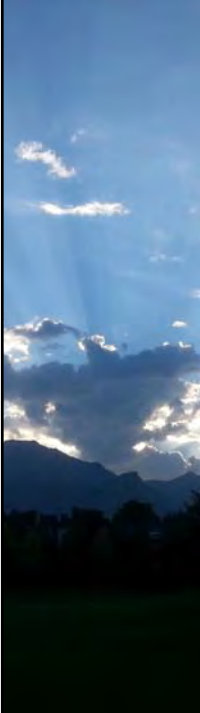


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 - **Yogurt**
 - **Kefir****

Johnson *et al.*, Int J Infect Dis. 2012; 16:e786-92
 Evans & Johnson, Clin Infect Dis 2015;60 (s2)S122-8
 Bakken. Clin Infect Dis 2014;59: 858-861
 Ehrhardt *et al.* OFID on-line January 2016
 **Bakken. CID 2014;59 (858-61)




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On the Horizon: Vaccines

- Tested in healthy adults 50-85 years old
- 3 dose regimen (0, 1 & 6 months)
- Generated antibodies against Toxins A & B lasting through (at least) 6 months post-vaccine
- Well-tolerated
- **Efficacy studies pending**

Sheldon *et al.*, *Vaccine*. 2016(34) 2082-2091



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Take Home Messages


- Antibiotic exposure is the main risk factor for *C. difficile* infection
- Metronidazole and oral vancomycin are the mainstays of treatment
- Fecal microbiota transplant is safe and effective
- More palatable options are becoming available



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**Together,
we can wipe out *C. diff***

Let's doo it!

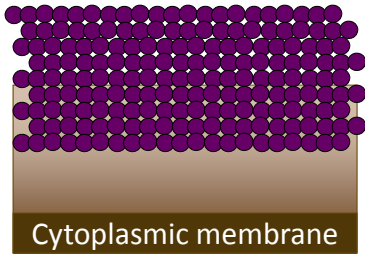


CRE

**Carbapenem-Resistant
Enterobacteriaceae**


Gram-Positive & Gram-Negative Bacteria

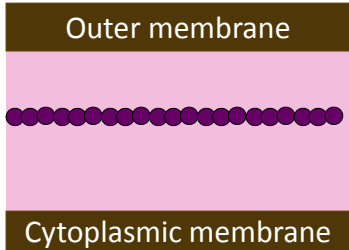
Peptidoglycan Layer



Cytoplasmic membrane

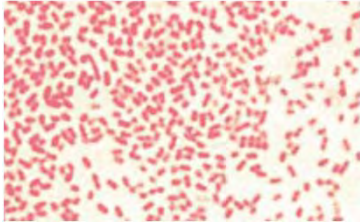
Staphylococcus aureus
Streptococci spp.






Outer membrane

Cytoplasmic membrane





Public Health Image Library

Gram Negative Bacteria

***Enterobacteriaceae* /**


Lactose-Fermenting

- *Escherichia coli*
- *Klebsiella* spp.
- *Enterobacter* spp.

Non-Lactose Fermenting


- *Pseudomonas aeruginosa*
- *Acinetobacter baumannii*

<http://www.cdc.gov/drugresistance/threat-report-2013/>



Antibiotics Used Against Gram-Negative Bacteria

1 st / 2 nd generation cephalosprins
Penicillins
Fluoroquinolones
Extended-spectrum cephalosporins
Beta-lactam inhibitor combinations
Carbapenems
Aminoglycosides
Tigecycline
Colistin



Alphabet Soup of MDR GN

- Fluoroquinolone-resistant GN bacteria
- Extended-spectrum Beta-lactamase (ESBL) producing bacteria
 - Resistant to amp/sulbactam, piperacillin/tazobactam, ceftriaxone, ceftazidime, aztreonam
 - Carbapenems are treatment of choice
- Carbapenem-Resistant *Enterobacteriaceae* (CRE)
 - *Klebsiella pneumoniae* carbapenemase (KPC)
 - New Delhi Metallo-beta-lactamase (NDM)
 - Resistant to ertapenem, meropenem, imipenem/cilastin, doripenem
 - Sometimes tigecycline, usually colistin....

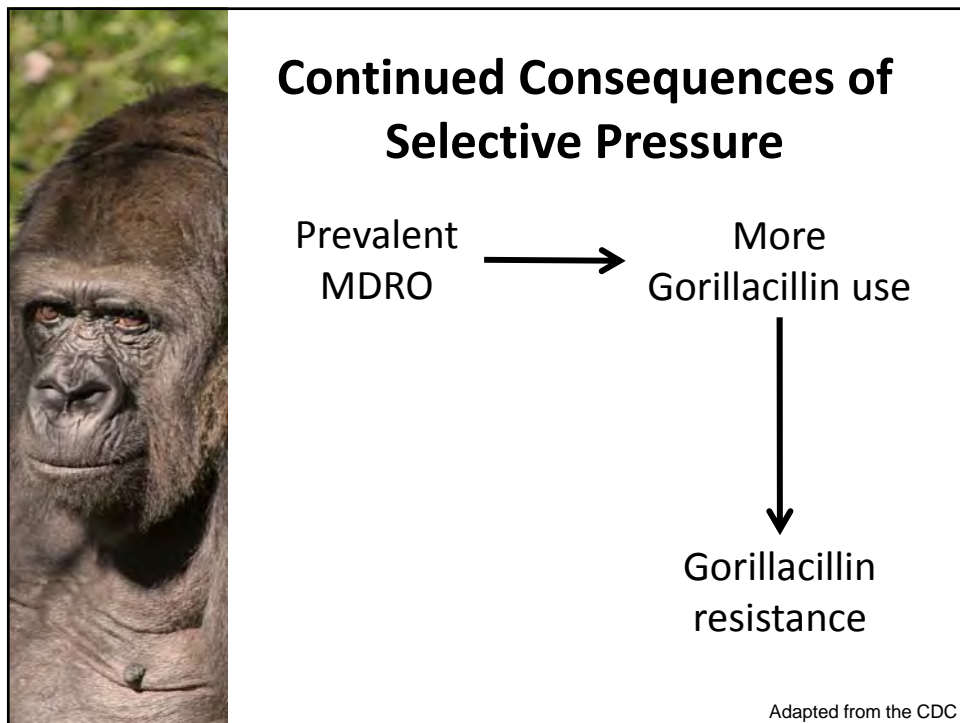
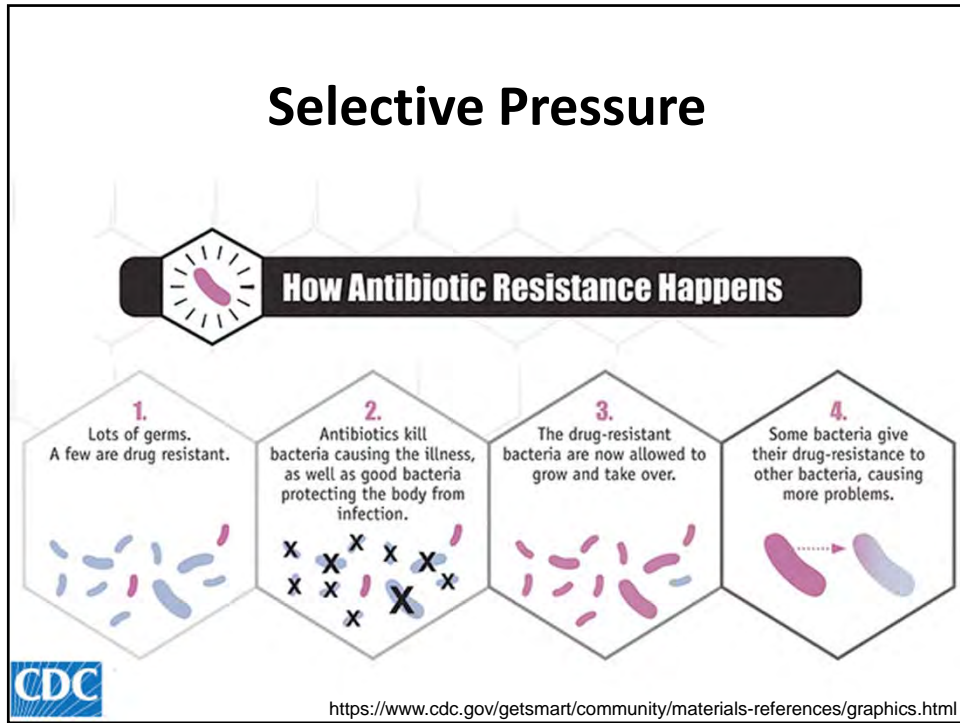
CDC's Guidance for Control of CRE – 2012 CRE Toolkit: http://www.cdc.gov/HAI/prevent/prevention_tools.html#lc

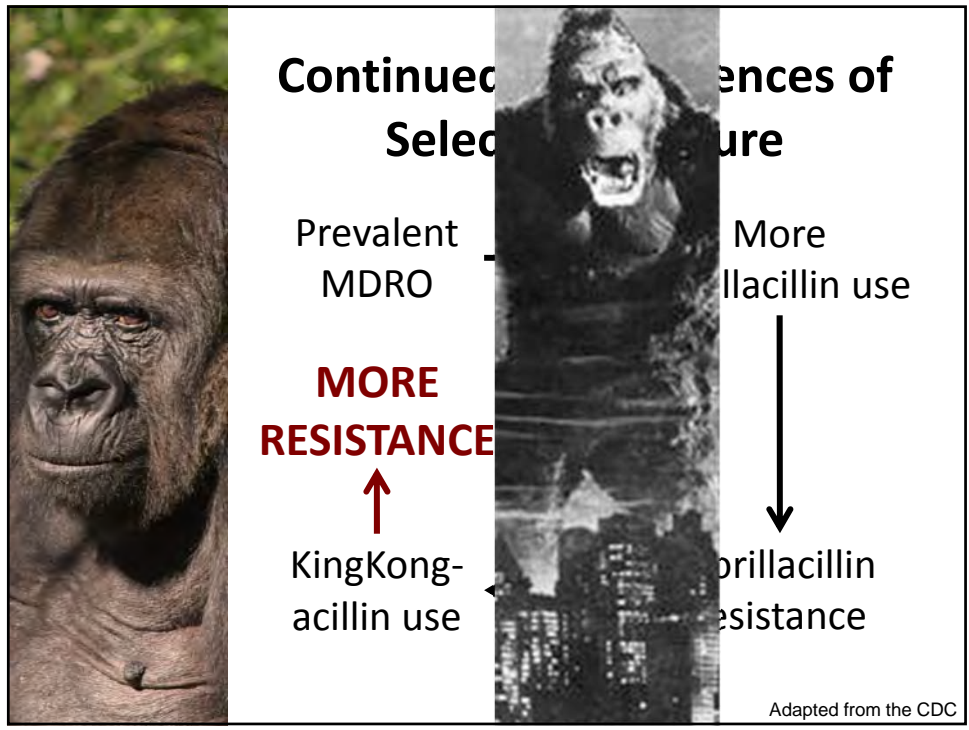
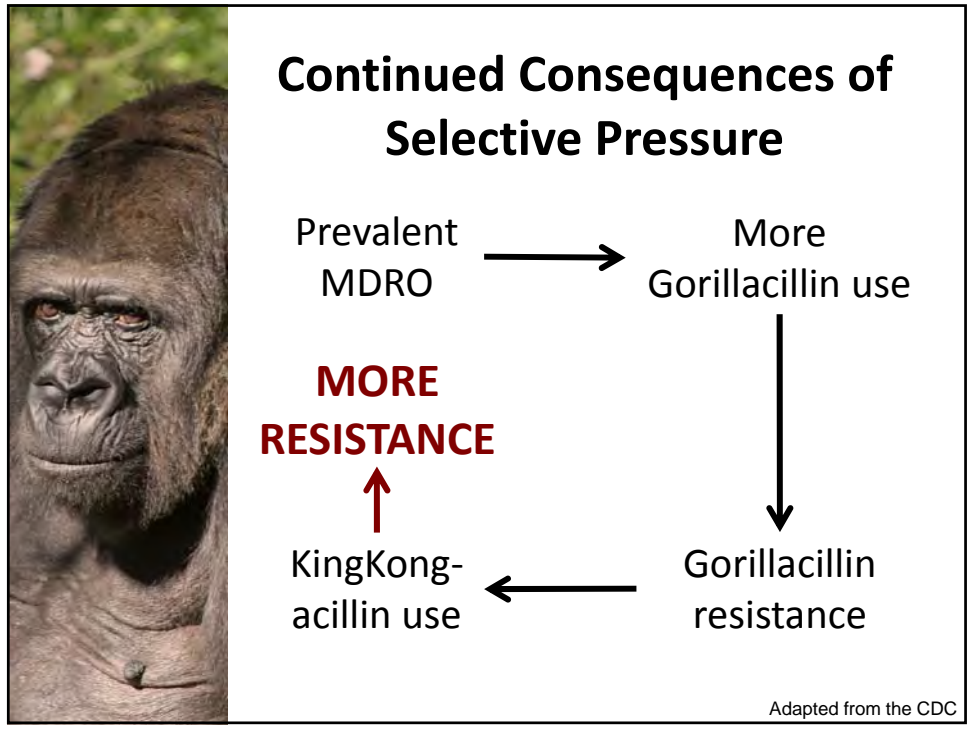
Why are CRE such a concern?



Antibiotics Used Against Gram-Negative Bacteria

1st/2nd-generation cephalosprins
Penicillins
Fluoroquinolones
Extended-spectrum cephalosporins
Beta-lactam inhibitor combinations
Carbapenems
Aminoglycosides
Tigecycline
Colistin





Continued
Selection

Prevalent
MDRO

**MORE
RESISTANCE**


↑
KingKong-
acillin use

Continued
Selection

Prevalent
MDRO

**MORE
RESISTANCE**

↑
KingKong-
acillin use




Reducing Selective Pressure?

Prevalent MDRO

↓

**Antibiotic stewardship
Infection prevention & control**

↓



Reducing Selective Pressure?

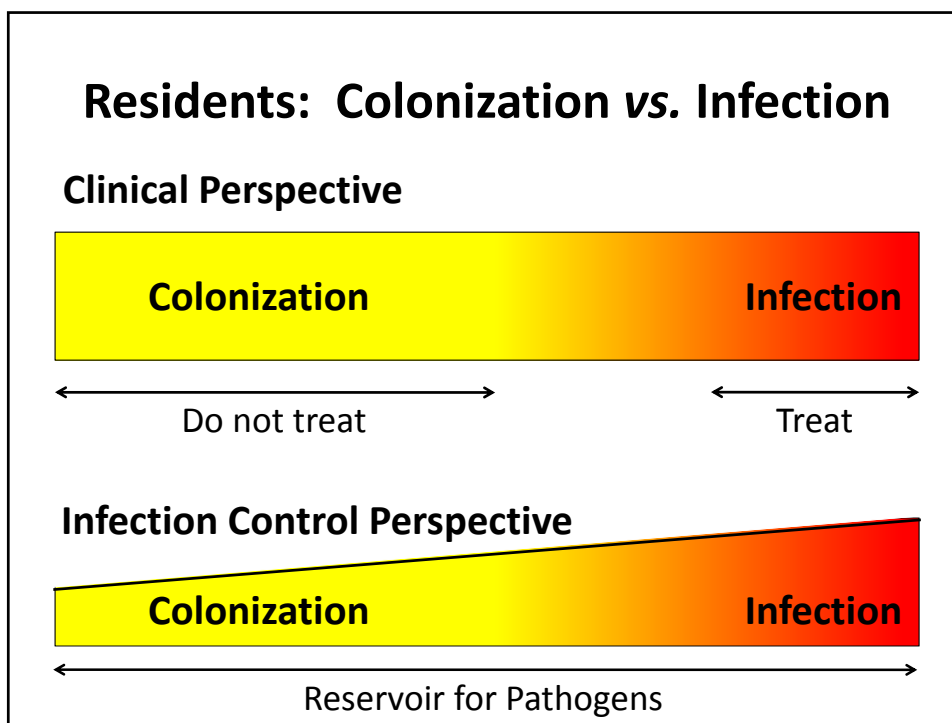
Prevalent MDRO


↓

**Antibiotic stewardship
Infection prevention & control**

↓

Decreased prevalent MDRO





Nursing Homes as Reservoirs of MDROs

- Analysis of MDS data over 15 months
- Of ~4 million NH residents, 5% with MDRO *infection*
- For those infected with an MDRO during the study, 57% in NH, 41% in acute care
- Colonization rate unknown

Kahvecioglu *et al.* ICHE 2014 35(S3):S48–S55

Carbapenem-Resistant *Klebsiella pneumoniae* Outbreak



- Hospital reported an outbreak
- Cases investigated from April 2009 – February 2011
- 19 cases identified
 - 16 admitted from a LTCF
 - 14 from LTCF A
- Genetic analysis >88% similarity among isolates

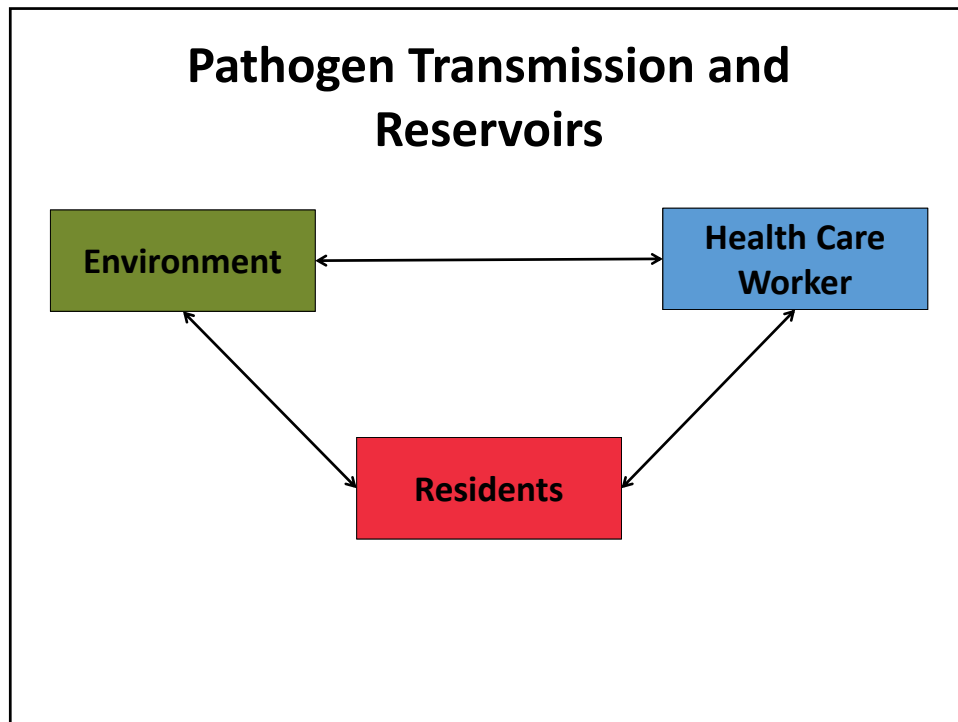
MMWR Oct 21, 2011 60(41) 1418-20

Field Investigation of LTCF A



- No infection preventionist x 9 months
- Did not record MDRO status of residents
- Hand hygiene stations not conveniently located
- PPE supplies not available for those on contact precautions
- 11 of 118 resident samples (9%) with CRE; 8 previously undetected

MMWR Oct 21, 2011 60(41) 1418-20




Pathogen Transmission in Nursing Homes

Transmission of MRSA to Healthcare Personnel Gowns and Gloves during Care of Nursing Home Residents

Mary-Claire Roghmann, MD, MS¹, J. Kristie Johnson, PhD², John D. Sorkin, MD, PhD³, Patricia Langenberg, PhD¹, Alison Lydecker, MPH¹, Brian Sorace, BS¹, Lauren Levy, JD, MPH¹, and Lona Mody, MD, MSc⁴

Glove contamination higher than gown contamination	High Risk Activities: Dressing Transferring Hygiene Changing Linens Toileting
Residents with skin breakdown had higher rates of transmission	


ICHE 2015 Sep 36(9):1050-1057



Isolation Precautions

Standard Precautions (aka Universal Precautions)	Infection prevention practices that apply to all residents, regardless of diagnosis or presumed infection status
Transmission-based Precautions (aka Isolation Precautions)	Actions beyond Standard Precautions based on means of transmission (i.e., airborne, droplet & contact)
Contact Precautions	Measures to prevent transmission of infectious agents spread by direct or indirect contact with the resident or their environment

2007 Guideline for Isolation Precautions (CDC HICPAC)



Colonization with MDR GN in Nursing Home Residents


Gram-negative bacteria may last hours to days to months on inanimate surfaces

Colonization with FQ-resistant GNR on average 76 days (\pm 66d) after admission

- Average length of stay is 463 days
- Up to 50% with quinolone-resistant Gram-negatives
- 17% with ESBL
- 1% with CRE

ESBL transmission rate of nearly 10% in a long-term care unit without contact precautions

Kramer *et al.* 2006 BMC Infectious Diseases 6:130; Tschudin-Sutter *et al.* 2016 22(6): 1094-1097
Reviewed in Dumyati *et al.* 2017. Current Infectious Disease Reports (*in press*)



Sites & Duration of Colonization with MDR GN

- May colonize **stool**
- May also colonize **urine, devices, wounds, skin**
- No protocols for declonization
- May continue to harbor organisms for months.
- Duration of contact precautions
 - ? Forever
 - ? 6 months **without hospitalizations, antimicrobial therapy, and invasive devices** before reculturing patients to document clearance of carriage

Siegal *et al.* 2007 <http://www.cdc.gov/ncidod/dhqp/pdf/isolation2007.pdf>

MDR GNB*

Core Prevention Strategies

- Hand hygiene
- Contact Precautions
- Recognize previously colonized patients
- Rapidly report ESBL & CRE lab results
- Provide ESBL & CRE education for healthcare providers
- Minimize use of devices
- Screen for ESBL & CRE

Adapted from the CDC



Risk Factors for Multi-Drug Resistant Organisms in NHs

- Recent antibiotic exposure (4 months)
- Dependence for assistance with ADLs
- Indwelling medical devices, decubitus ulcers, other wounds, urinary and fecal incontinence

Reviewed in Domyati *et al.* 2017 Current Infectious Disease Reports (*in press*)



Contact Precautions for In-Room Care

- Hand hygiene
- Gowns, gloves upon entry
- Removal of gowns, gloves at exit
- Hand hygiene
- Single use equipment
- Dedicate equipment to individual resident when possible
- Clean/disinfect between individuals

**The burden is on
healthcare workers**



Socialization & Other Ideas

- Encourage resident hand hygiene
- Clean
- Contained
- Cooperative

May cohort with a “low risk roommate”

- No (major) wounds.
- No invasive devices.
- Not immunocompromised.
- No recent antibiotic exposure (?)

Designate someone to restock PPE on every shift




Targeted Infection Prevention Study

For residents with urinary catheters or feeding tubes

- Hand hygiene before/after care
- Gown & glove use during morning/evening care, device care
- Staff education (intensive!)
- Active surveillance for MDROs

Mody *et al.* JAMA Int Med. 2015 175(5);714-723

Targeted Infection Prevention Study



- 418 residents enrolled; >6000 samples


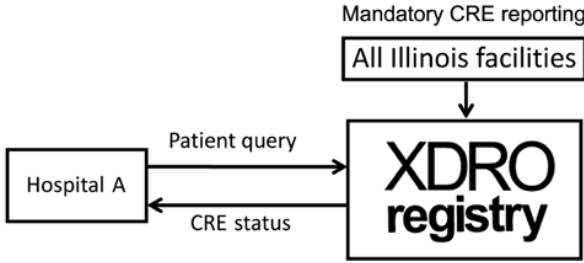
Outcome	Rate Ratio
MDRO prevalence	0.77
New MRSA acquisitions	0.78
Risk of first CAUTI	0.54
Risk of all CAUTI	0.69

- No change in GNR acquisition, feeding-tube associated pneumonia or skin/soft tissue infections

Mody et al. JAMA Int Med. 2015 175(5):714-723

Regional Approach to Infection Control

- Automated, **regional** sharing of information about CRE
- In 1 year, ~1500 reports of CRE from 115 hospitals, 5 LTACHs, 46 long-term care facilities and 7 reference laboratories

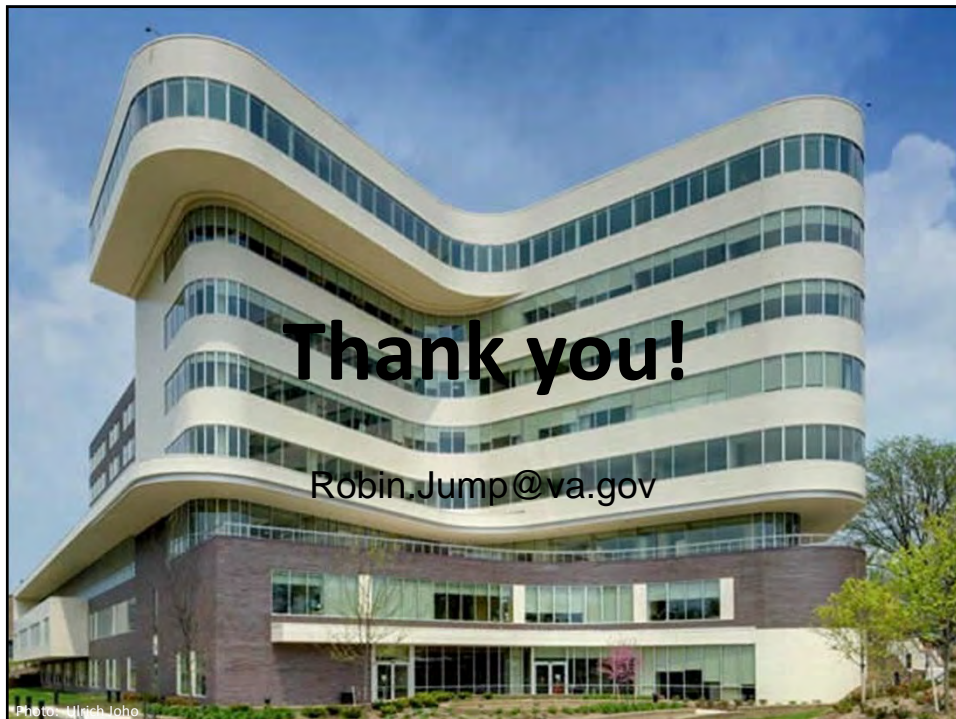
CRE information exchange
(interfacility communication)

Trick et al. Oct 2015 Emerg Inf Dis 21(10) 1725-32 Ray et al. Oct 2016 Clin Infed Dise 63(7):889-93



Take Home Messages

- Balance between resident safety and individual liberty
- Any resident with an MDRO is a reservoir for that organism
- Activities most linked to transmission involve a health care workers (*i.e.*, not resident-to-resident)
- For MDROs, transmission-based precautions based on resident risk factors may be most rational, feasible strategy
- Coordinated, regional approaches feasible, helpful and necessary



Thank you!

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Photo: Mich Ioho