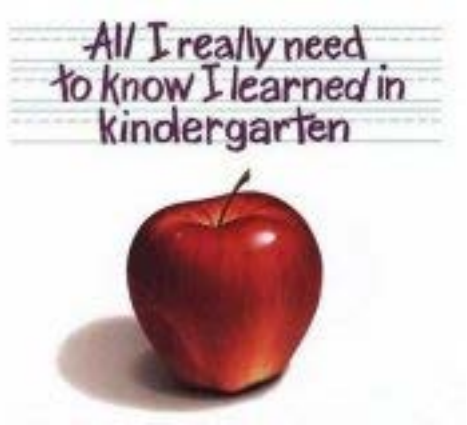
Good Kindergarten Lessons Gone Bad: Stop Sharing Now!



Dr. Mark Joffe

University of Alberta

Alberta Health Services

Celebrating 10 years of collaboration
Célébrons 10 années de collaboration!
Charlottetown 2015

AMMI Canada – CACMID
Annual Conference • Conférence annuelle
Delta Prince Edward and Prince Edward Island Convention Centre
April 16 – 18 avril

Disclosures

- Advisory Boards
  - Abbvie; Merck; Paladin Labs
- Speaker’s Bureau
  - Merck;
- Clinical Trial Research Funding
  - Optimer; Cubist

Objectives

- To describe existing and novel approaches to public health management of gonococcal infection
- To discuss advances in Infection Prevention and Control pertinent to management of *C difficile* and CPO's

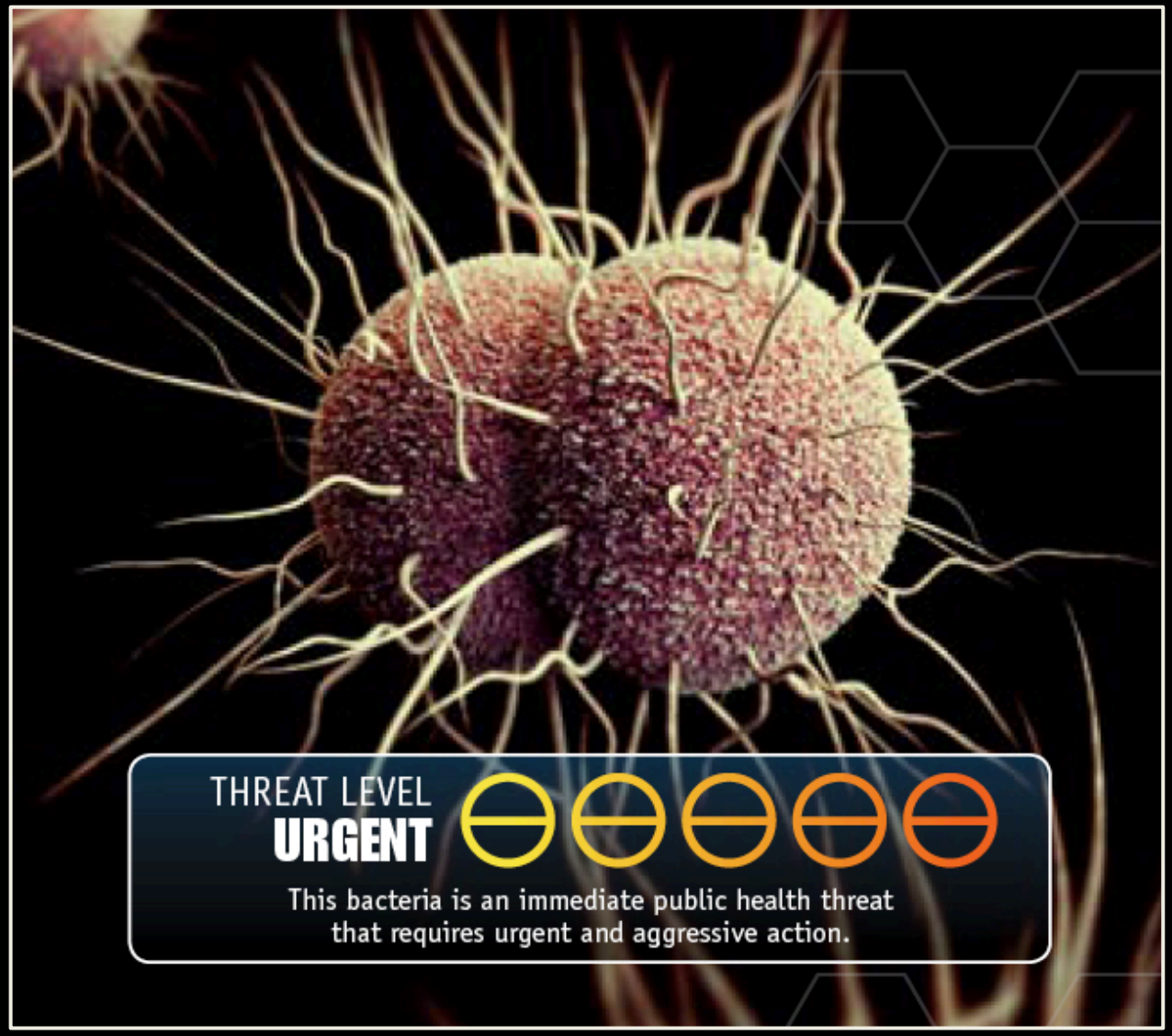
Big 3

Epidemiology

&

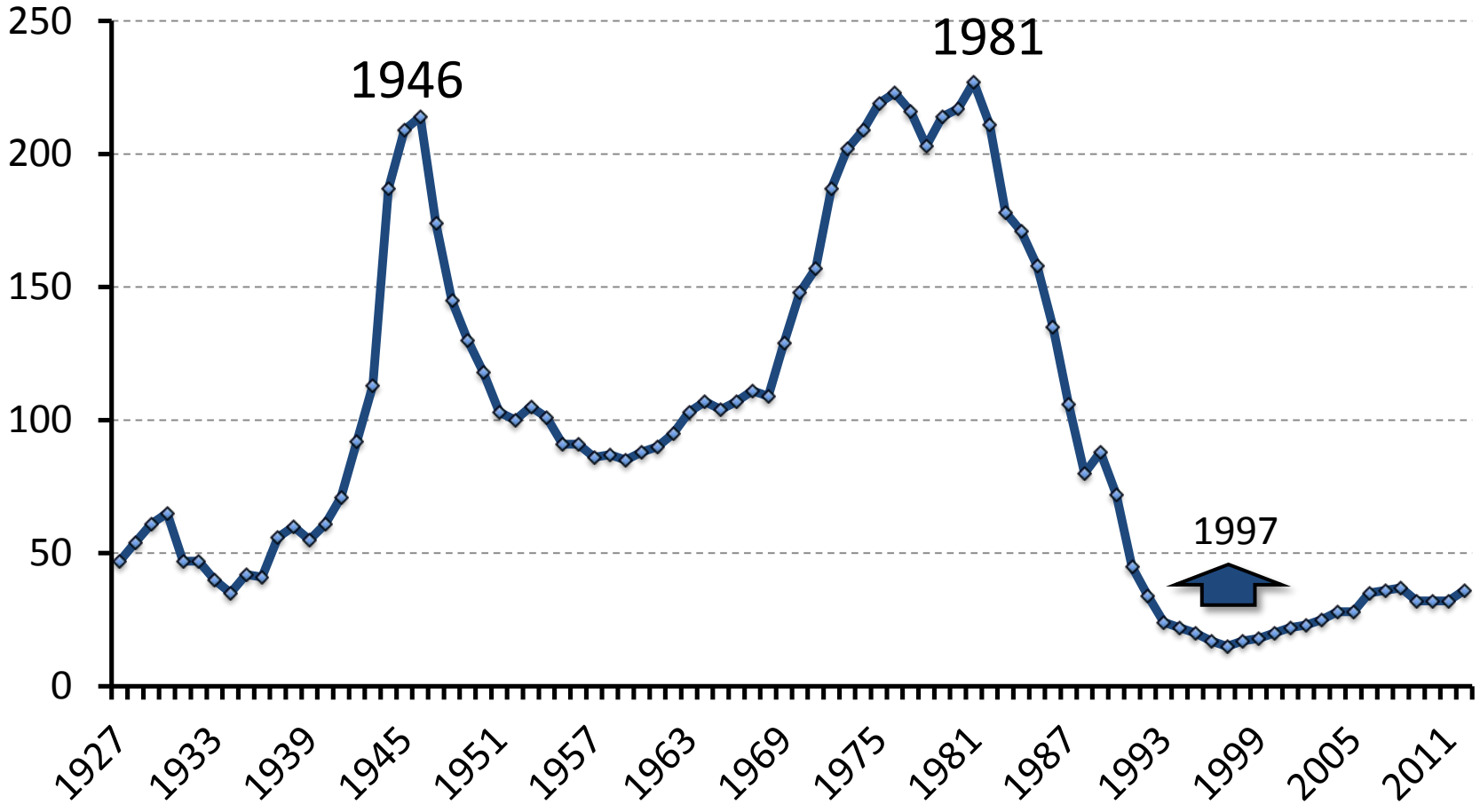
Prevention

Drug-Resistant *Neisseria gonorrhea*



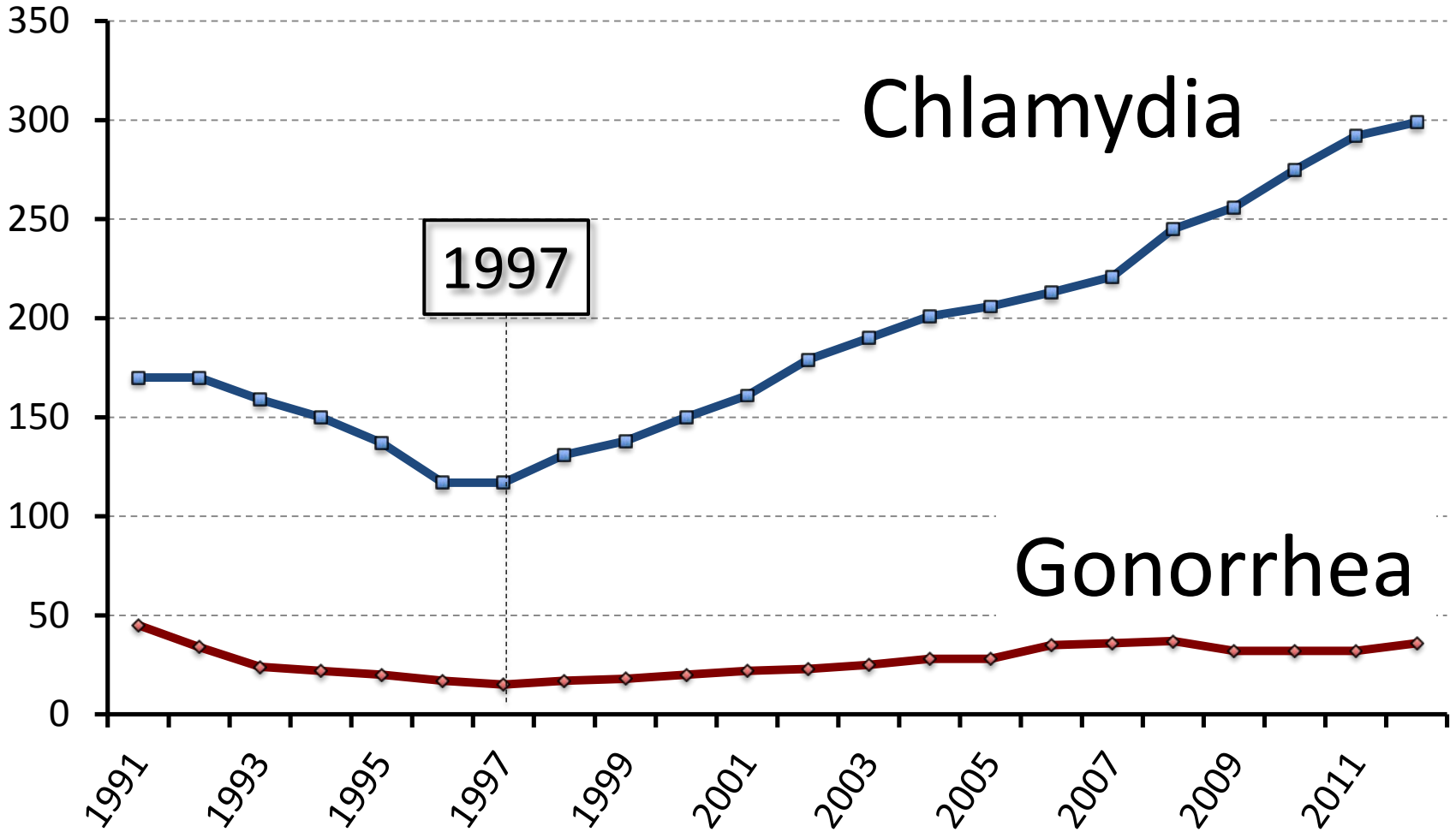
Gonorrhea in Canada 1927-2012

Rate per 100,000 population



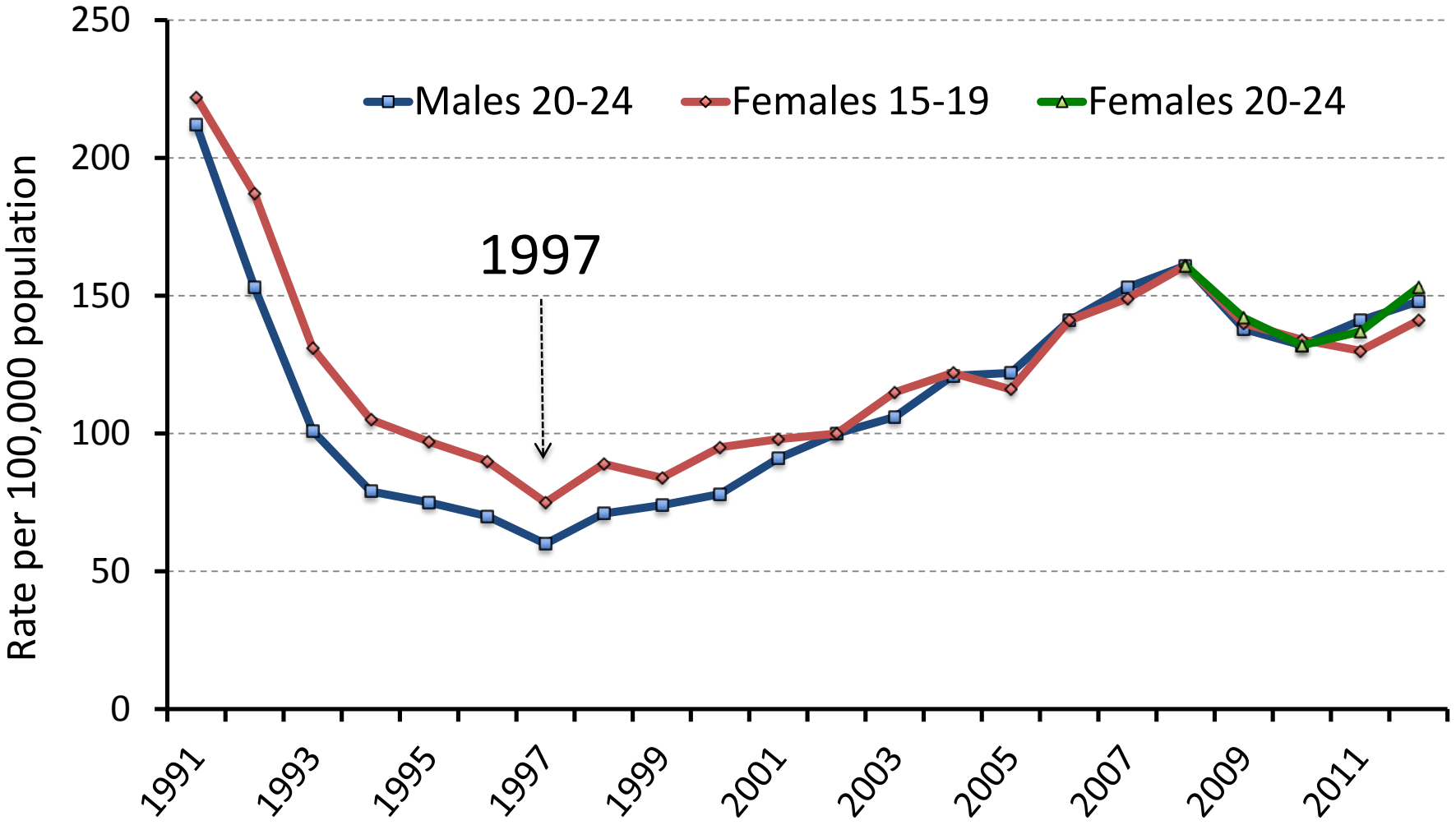
http://dsol-smed.phac-aspc.gc.ca/dsol-smed/ndis/charts.php?c=pl

Chlamydia and Gonorrhea in Canada Rates Per 100,000 1991-2012



Gonorrhea in Canada 1991-2012

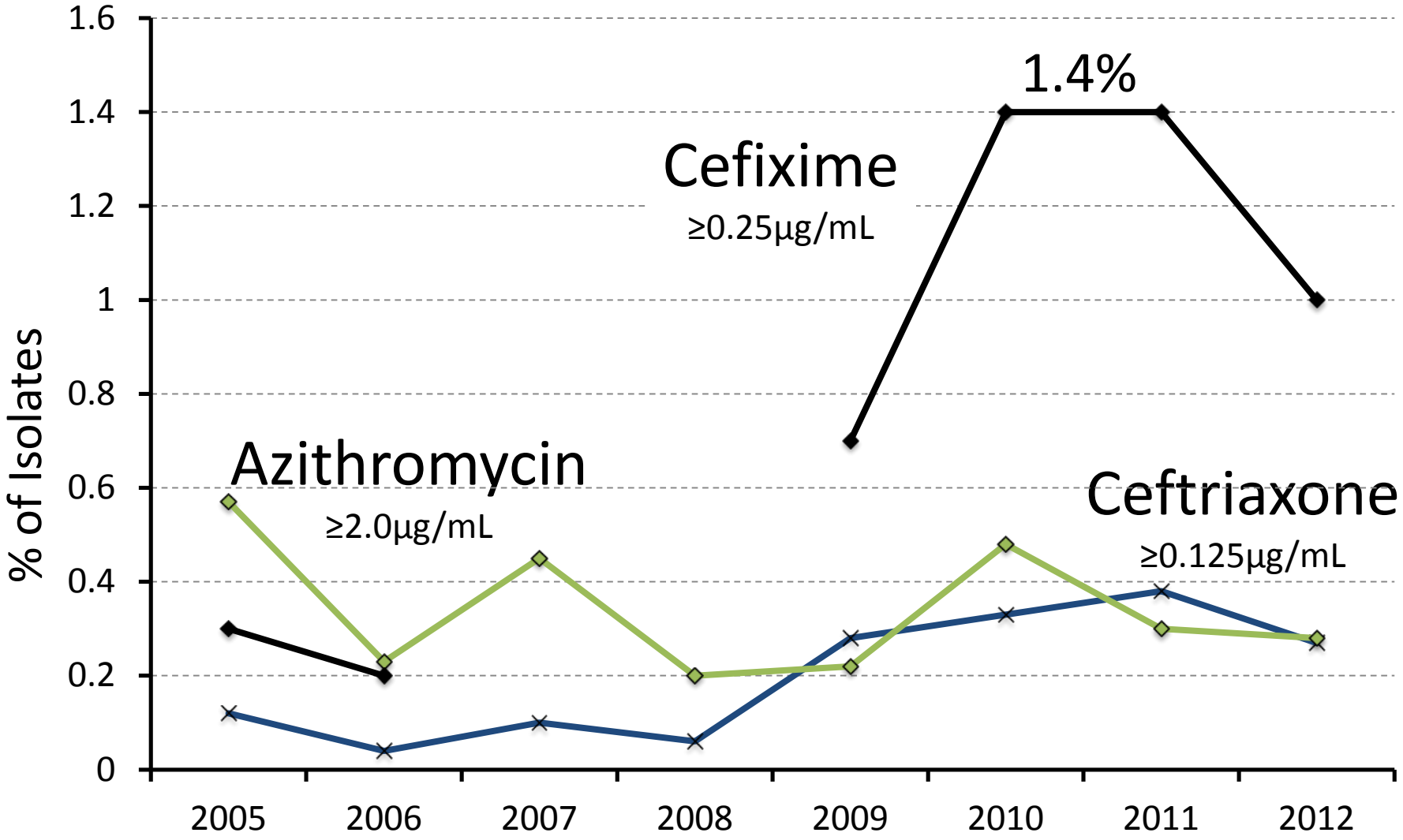
Rate per 100,000 in Men 20-24 and Women 15-19



http://dsol-smed.phac-aspc.gc.ca/dsol-smed/ndis/charts.php?c=abs

Proportion of GC with Elevated MIC

CDC GISP Program



http://www.cdc.gov/std/stats12/gonorrhea.htm

Neisseria gonorrhoeae Treatment Failure and Susceptibility to Cefixime in Toronto, Canada

Allen, V.G. et al, and Low, D.E. JAMA 2013;309:163-170.

"The rate of clinical failure following treatment with Cefixime at a Toronto clinic was relatively high."

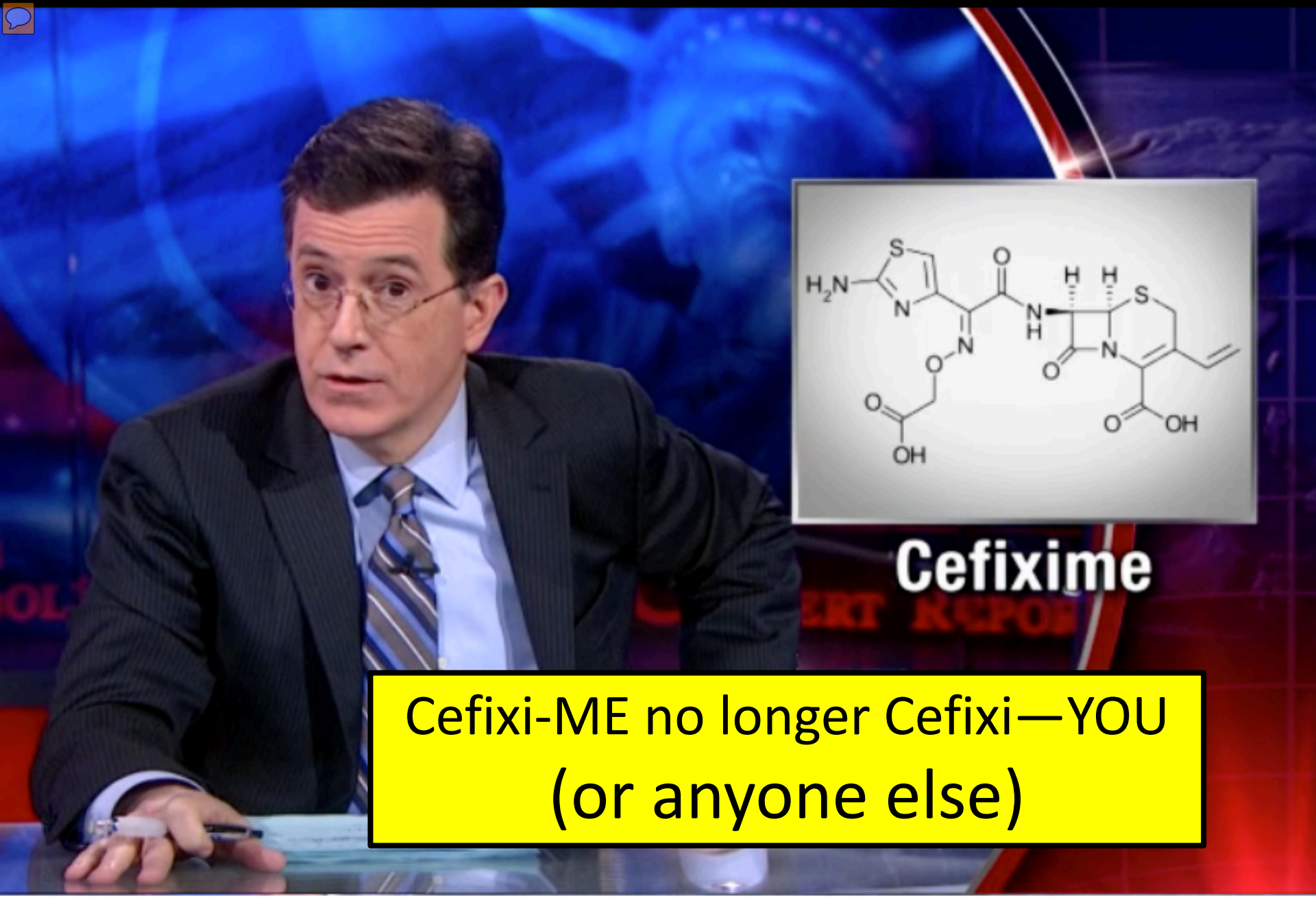
Cephalosporin-Resistant Gonorrhea in North America

"The threat of drug-resistant Gonorrhea is increasing and has reached North America." The time to act is now.

Kirkcaldy, R.D, et al. JAMA 2013;209:185-187

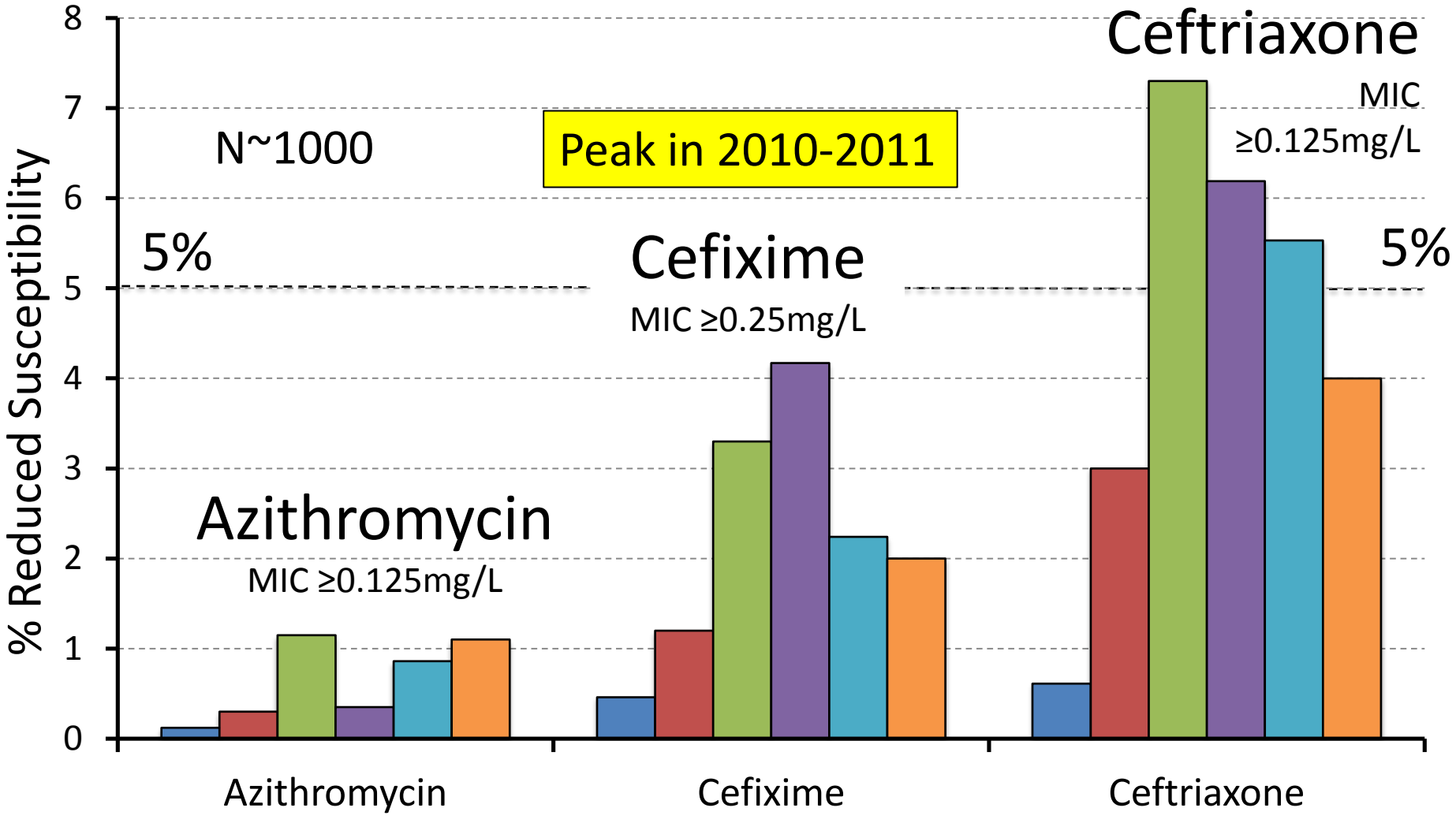
The Colbert Report January 21, 2013

The Colbert Report January 21, 2013



The Colbert Report January 21, 2013

N. gonorrhoeae with Reduced Susceptibilities in Canada 2008-2013



http://publications.gc.ca/collections/collection_2014/aspc-phac/HP57-3-2012-eng.pdf

Resistance and Treatment Failures are Not Widespread

BUT: the prospect of an era of untreatable gonorrhea calls for urgent new strategies for treatment and public health control measures

Pharynx and the Evolution of Antimicrobial Resistance in *Neisseria gonorrhoeae*

- Very common (especially MSM), asymptomatic and Not Screened
- Eradication more difficult
- Reservoir – Promotes Emergence of Resistance

Barbee, L.A. Curr Opin Infect Dis 2014;27:282-287.

WHO 2012 Action Plan

Global action plan

to control the spread and impact of

antimicrobial resistance in *Neisseria gonorrhoeae*

World Health Organization

http://whqlibdoc.who.int/publications/2012/9789241503501_eng.pdf?ua=1

WHO Action Plan: Key Populations

- Sex Workers and Their Clients
- MSM
- Injection Drug Users
- STI Clinic Attendees
- Other groups based on local evidence

http://whqlibdoc.who.int/publications/2012/9789241503501_eng.pdf?ua=1

Oil companies urged to promote safe sex among their workers

MARIAM IBRAHIM
Edmonton Journal

As sexually transmitted infections and HIV continue to rise across the province, experts say employers in Alberta's oilpatch need to be more proactive about encouraging safe-sex practices among their workers.

Alberta Health's 2013 annual report on notifiable sexually transmitted infections, released late last week, shows HIV rates have increased for the third year in a row. With the exception of syphilis, overall infection rates were highest in Edmonton and northern Alberta.

The report notes immigrants, foreign workers and refugees from countries where HIV is prevalent can impact rates across the province. Dr. James Talbot, chief medical officer of health, said officials need to more closely study the rates of HIV infection in northern Alberta, which features a large population of men and transient workers.

See SAFE SEX page A2

'One of our big goals is to ... get condoms into the camps'

Edmonton Journal February 9, 2015


ALBERTA
WE ARE CURRENTLY
BOOMING
BUSTING
MORE
Gonorrhea
LESS
Gonorrhea
LaMontagne
carbonink.com
PATRICK LAMONTAGNE

Focus in Canada

- Promote appropriate lab testing (culture)
- Optimal treatment
- Test-of-cure
- Detection, reporting and re-treatment of those who fail initial treatment

Importance of Cultures for GC

Culture + NAAT

- Where culture is available, it is recommended that both NAAT & Culture be used in order to:
  - Individual strain susceptibility
  - Surveillance for drug resistance in Canada

Send Cultures For:

- Symptomatic Disease
- MSM
- Women with PID
- Acquired in areas with high rates of AMR
- Treatment failures

Test of Cure

- Follow up **CULTURES** from all positive sites **3-7 days** after completing therapy
- (Or NAAT 2-3 weeks following treatment)

Test of Cure - CRITICAL

- Symptoms or Signs persist post-therapy
- Pharyngeal infections
- Non-Standard Treatment
- Case linked to drug resistant or treatment failure case

Treatment Failure

- Positive CULTURE taken ≥ 72h following treatment*
- Positive NAAT taken 2-3 weeks after treatment*
- Presence of intracellular gram-negative diplococci on microscopy taken ≥ 72h following treatment*

* In absence of sex during post-treatment period and possible reinfection

Public Health Agency of Canada
Agence de la santé publique du Canada

Partner (Contact) Tracing

Trace, Test and Treat

all contacts in the last 60 days

Public Health Agency of Canada
Agence de la santé publique du Canada

Re-screen All Individuals

Diagnosed with GC after 6 mos

Public Health Agency of Canada
Agence de la santé publique du Canada

Prevention & Control

Screen all sexually active women ≤ 25y

Screen women >25y deemed at risk

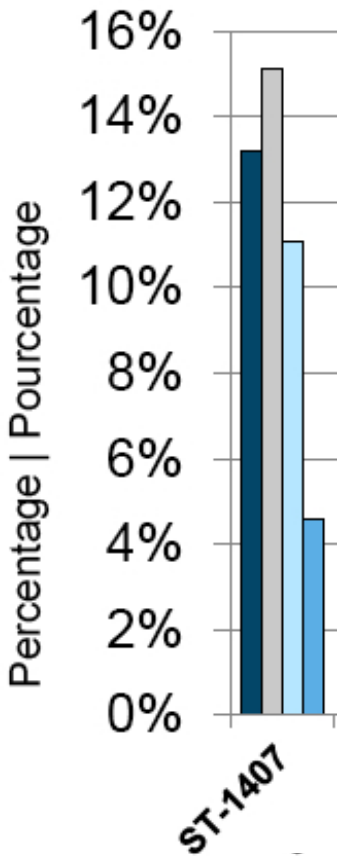
Screen all MSM – include rectum and pharynx

Recommend Condoms

NML Enhanced GC Surveillance

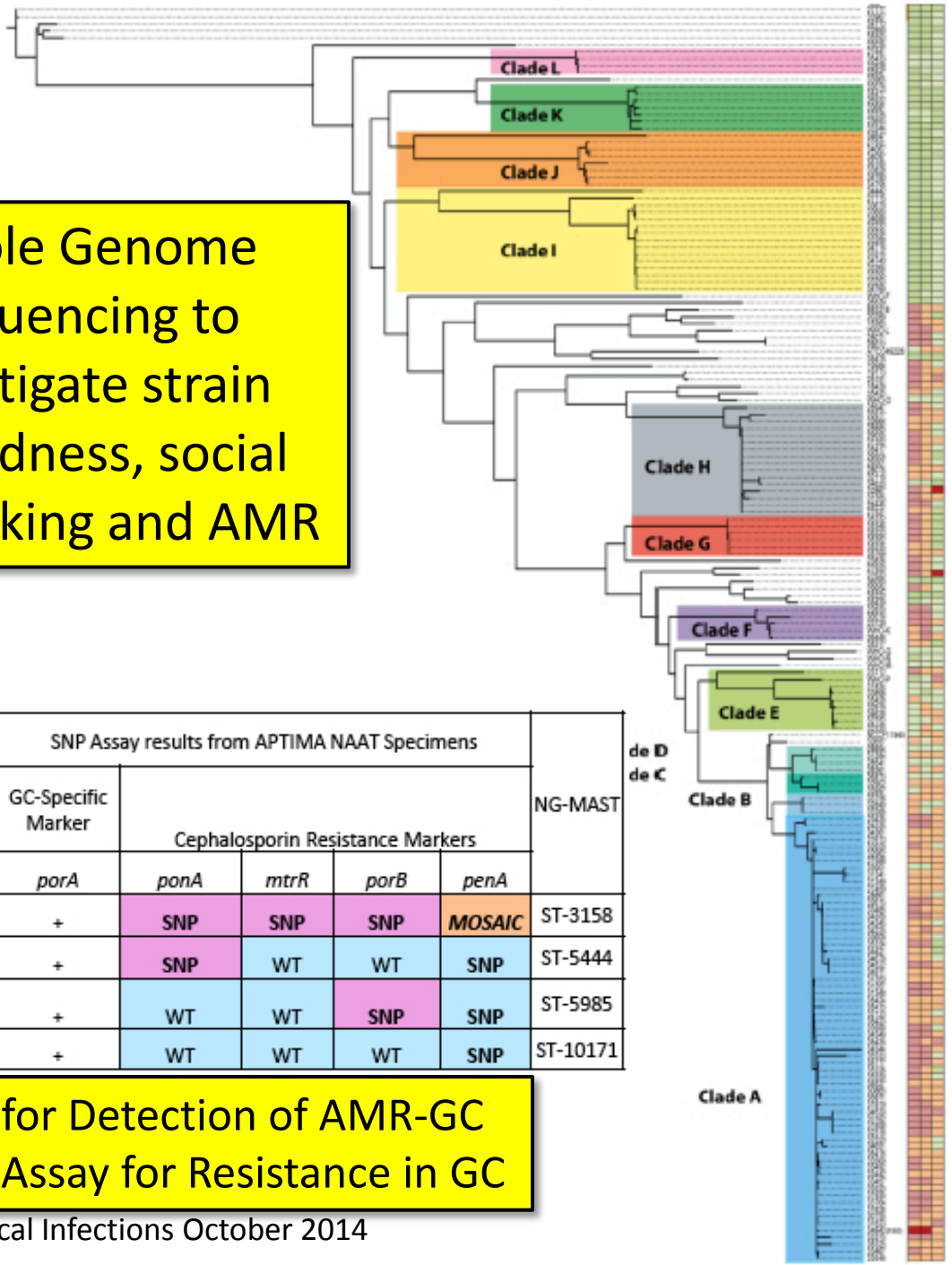
5 Sentinel Sites across Canada submit isolates with clinical data to link lab and epi data to enhance understanding of GC AMR

Public Health Agency of Canada | Agence de la santé publique du Canada



NG-MAST
por and *tbpB*
Sequence Typing

Whole Genome Sequencing to investigate strain relatedness, social networking and AMR



Isolate	Matched Isolate MICs*		SNP Assay results from APTIMA NAAT Specimens					NG-MAST
			GC-Specific Marker	Cephalosporin Resistance Markers				
	Ceftriaxone	Cefixime	*porA*	*ponA*	*mtrR*	*porB*	*penA*	
1	0.25	0.25	+	SNP	SNP	SNP	*MOSAIC*	ST-3158
2	0.008	0.032	+	SNP	WT	WT	SNP	ST-5444
3	0.016	0.016	+	WT	WT	SNP	SNP	ST-5985
4	0.008	0.016	+	WT	WT	WT	SNP	ST-10171

SNP Assay for Detection of AMR-GC
Molecular Assay for Resistance in GC

Delaying Resistance in GC

- Culture (vs NAAT)
- Stick to recommended treatment
  - Increased dosage
  - Combination therapy
  - IM vs PO treatment for cases requiring higher tissue penetration to achieve cure (Pharyngeal Infection, PID, Epididymitis)
- Test of Cure

There’s an App for That!

There's an App for That!

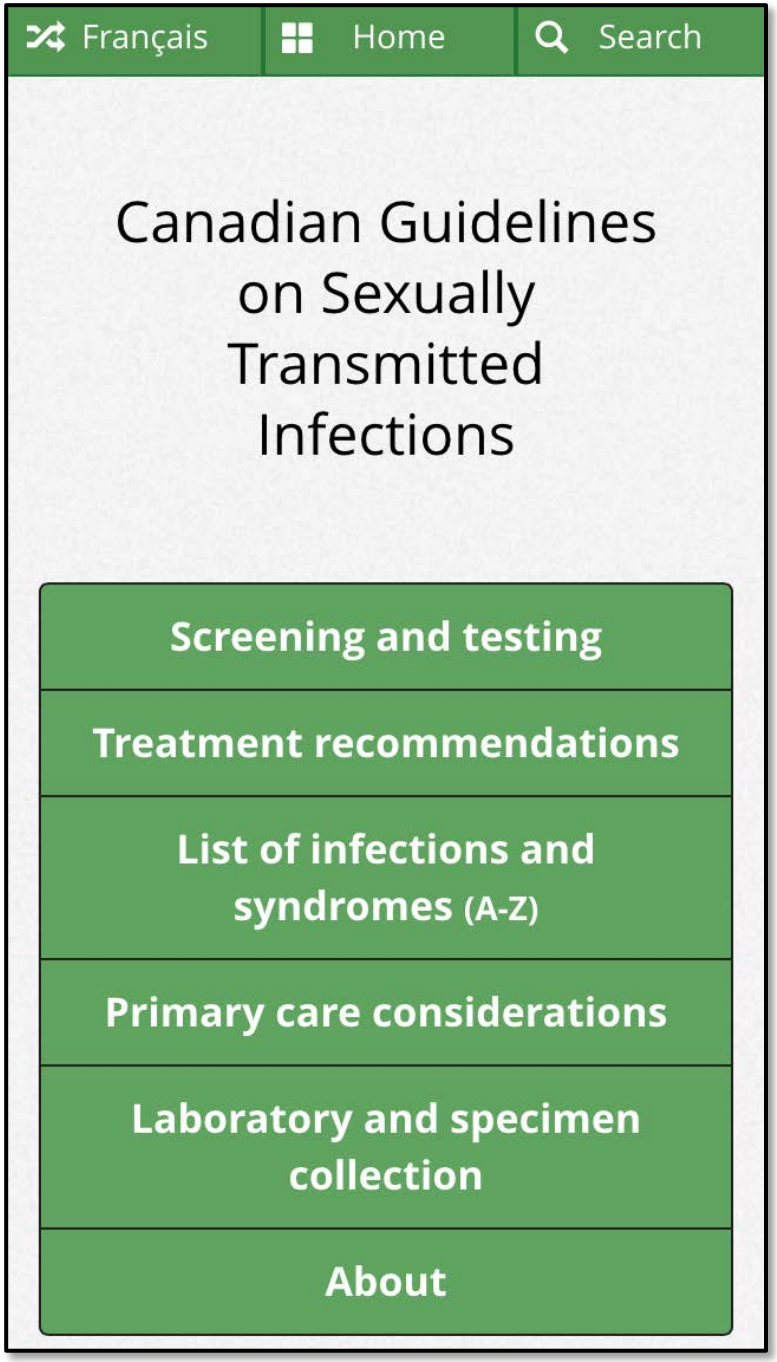
Controlling GC Resistance

Culture

Recommended Treatment

Test of Cure

Contact Tracing & Treatment



Gerard 1830

CID Cover Art
Feb. 1, 2015

"Would you like to come up with me, young sir—you will not be disappointed, come."

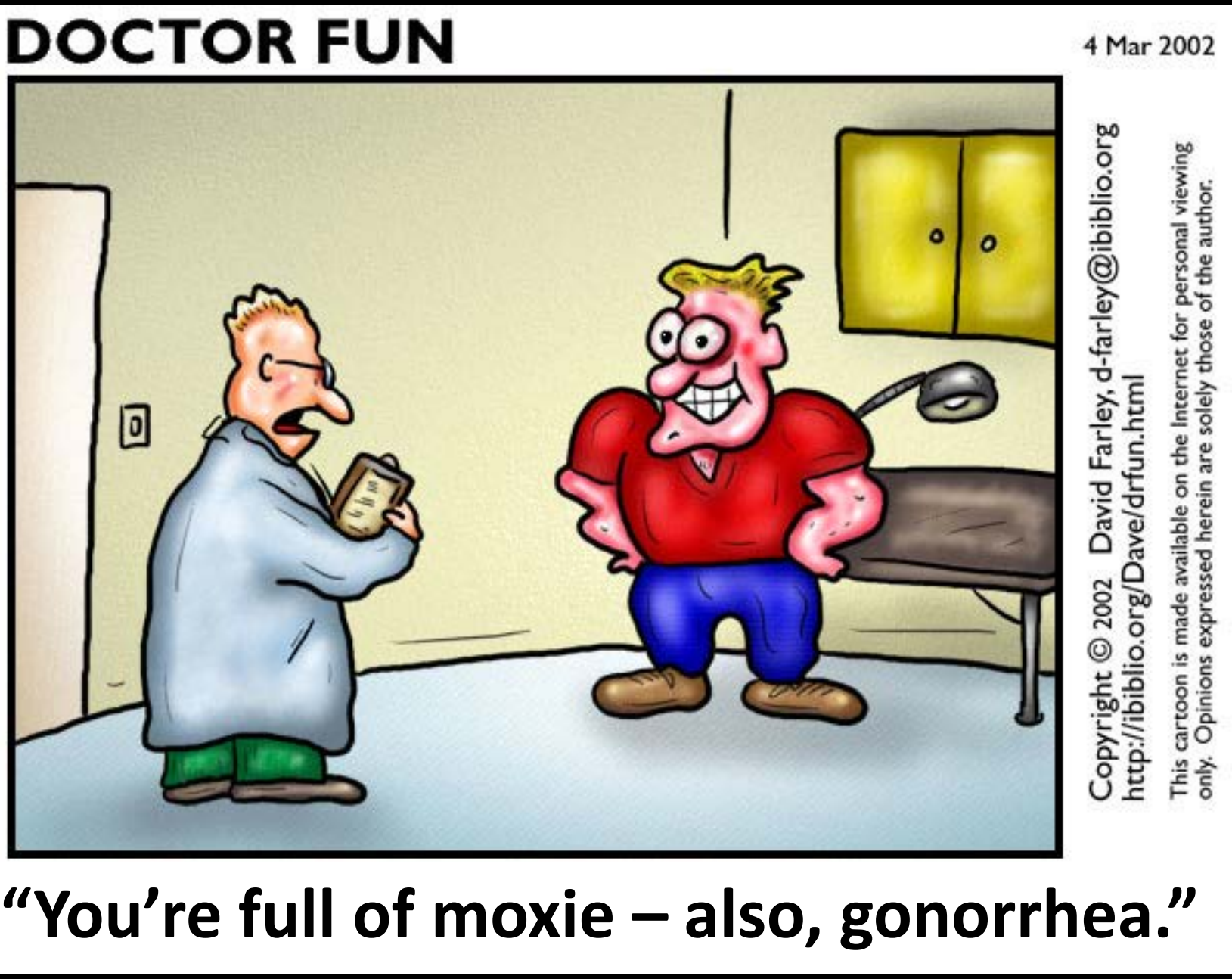
PICK-UPS
"GOOD TIME" GIRLS
PROSTITUTES

SPREAD SYPHILIS AND GONORRHEA

You can't beat the Axis if you get VD

CDC warns untreatable gonorrhea could spread like wildfire

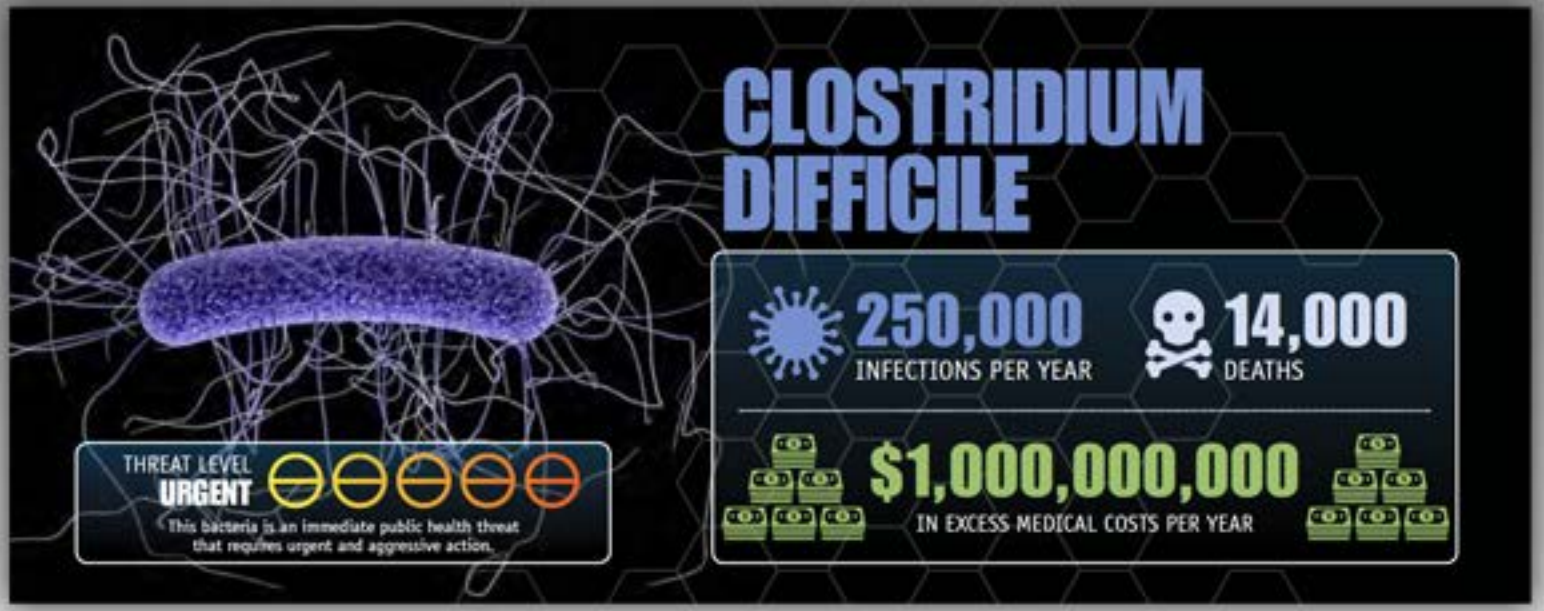
http://io9.com/cdc-study-warns-untreatable-gonorrhea-could-spread-like-1543978487



“You’re full of moxie – also, gonorrhea.”

Clostridium difficile

URGENT



U.S. CDC Antibiotic Resistance Threats, April 2013

250,000 Infections

14,000 Deaths

1 B Dollars

ORIGINAL ARTICLE

Burden of *Clostridium difficile* Infection in the United States

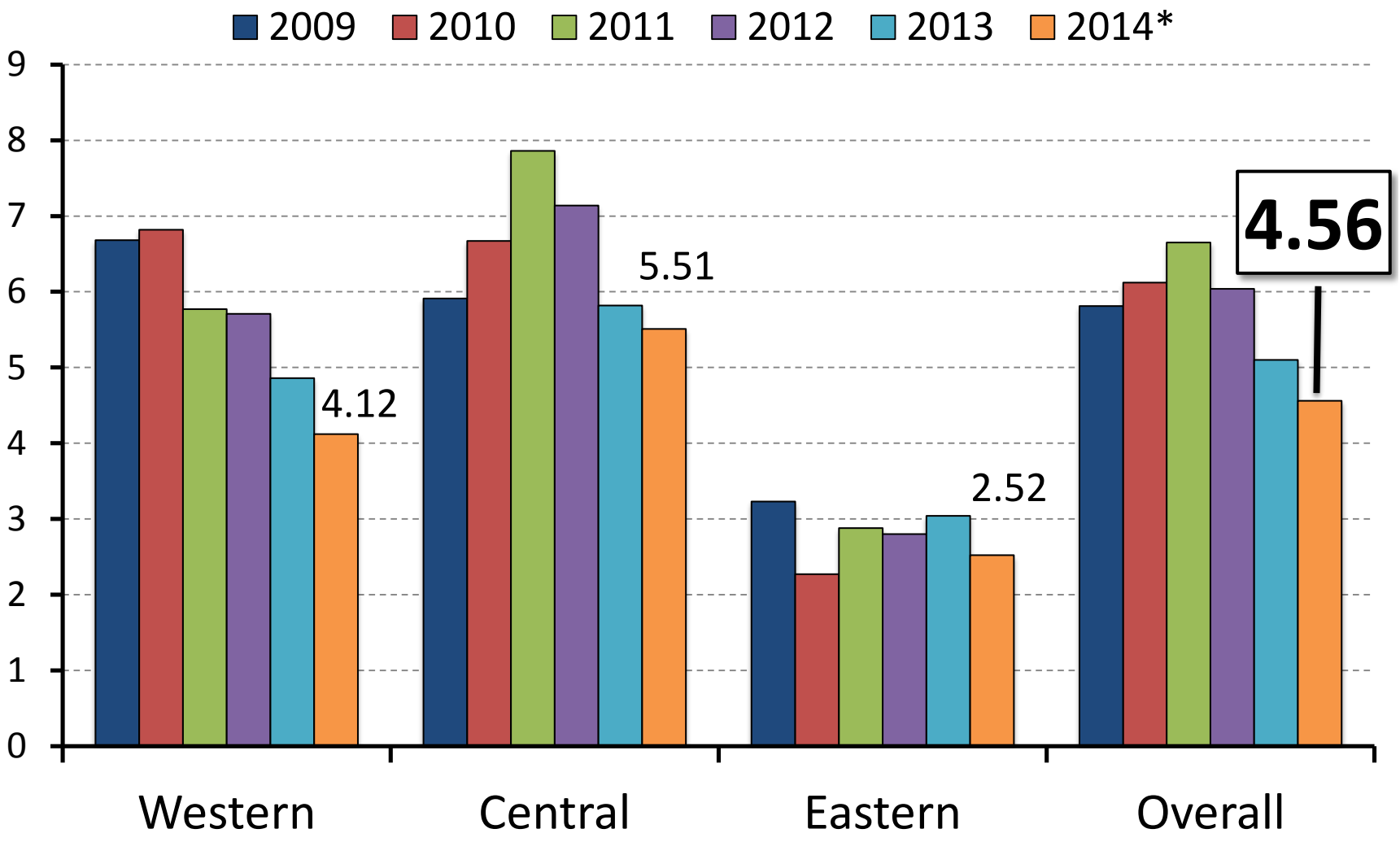
453,000 *C. difficile* infections in the U.S. in 2011

(range 397,000 – 509,000)

with approximately **29,300** deaths

Lessa, F.C. et al N Engl J Med;2015:372:825-34.

CDI Incidence per 10,000 patient-days



CNISP ARO Surveillance Report January 2015

*2014 data incomplete

C. difficile is a Nosocomial Disease

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE ARCHIVE

N Engl J Med 1989; 320:204–10.

Nosocomial Acquisition of *Clostridium difficile* Infection

Lynne V. McFarland, Ph.D., Maury E. Mulligan, M.D., Richard Y.Y. Kwok, M.S., and Walter E. Stamm, M.D.

Prospective monitoring of 428 admissions to a General Medicine Ward over 11 months – 21% acquired *C. difficile* and 37% of these developed diarrhea. Patient-to-Patient transmission was evidenced by time-space clustering and typing. 59% of HCW's had positive cultures for *C. difficile* on their hands.

C. difficile is transmitted among hospitalized patients and the organism is often present on the hands of hospital personnel.

Symptomatic patients in Hospitals are the primary source of CDI transmission.

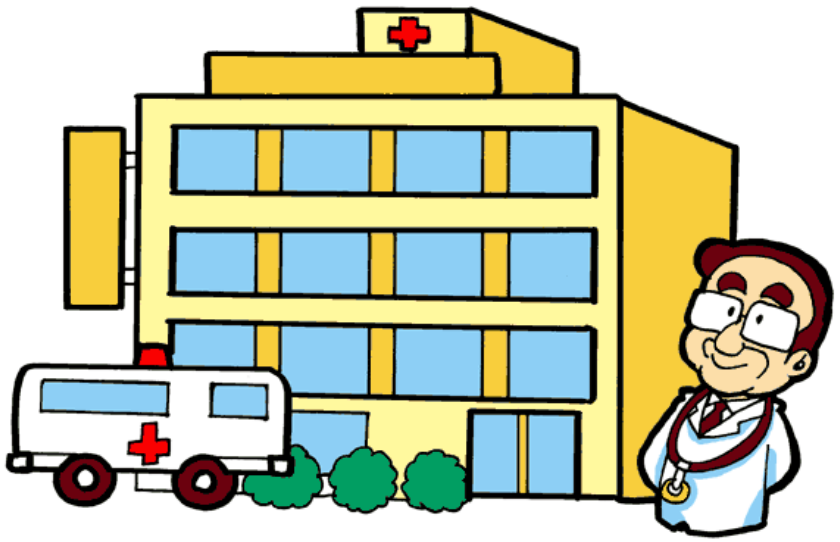
Ideal *C. difficile* Distribution System

Sick people needing lots of hands-on care

Inadequate Housekeeping

Crowded

Shared Rooms



Poor cleaning of shared equipment

Shared Bathrooms

Poor Hand Hygiene

Lots of Patient Movement

PPI's

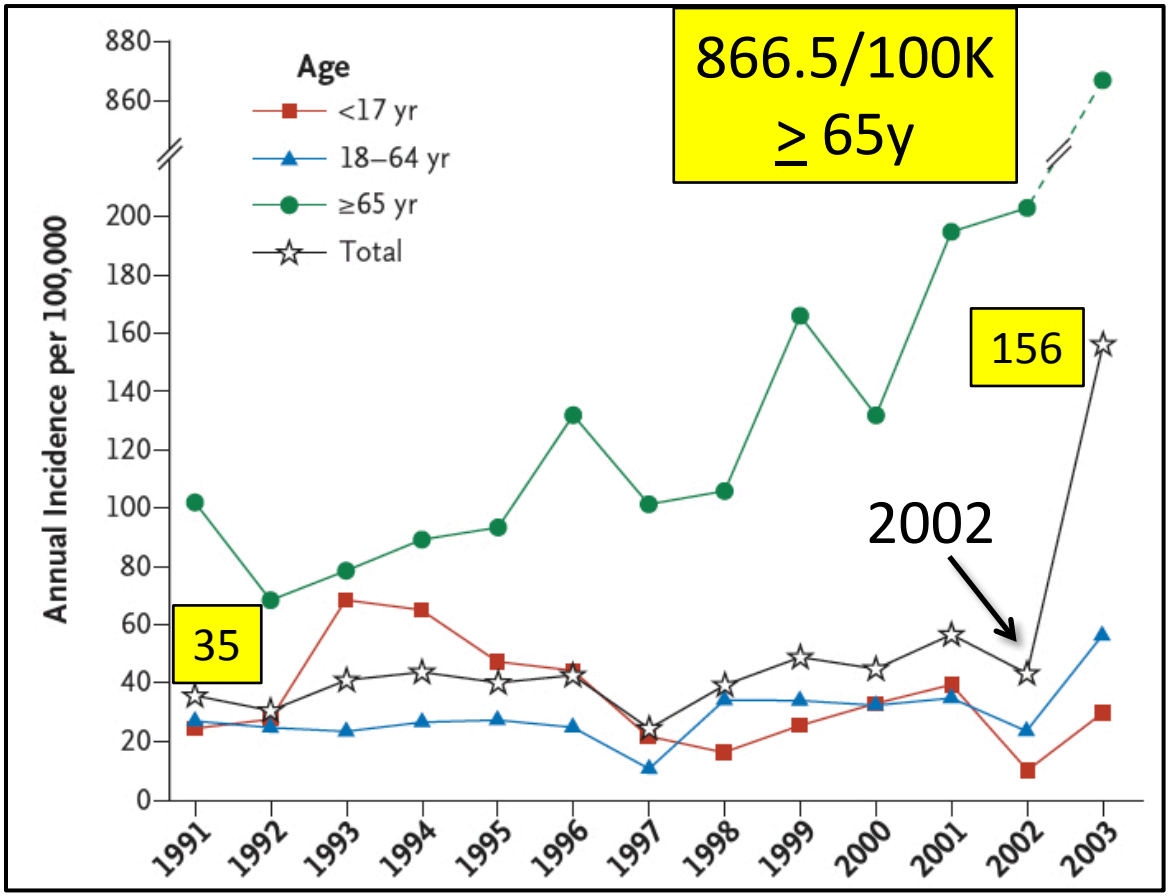
hospital

Poor Isolation Practices (Ignore Isolation Practices)

Lots of Broad-Spectrum Antibiotic Use

Everything I thought I knew turns out to be mostly wrong

Clostridium difficile-associated diarrhea in a region of Quebec from 1991 to 2003: a changing pattern of disease severity



- 4 fold rise in CDAD
- 10 fold rise in those 65 and older – mostly hospital acquired
- Complicated CDAD and Case-Fatality Increase
- Flagyl Failing?

Pepin J. et al. CMAJ 2004;171:466-72.

ORIGINAL ARTICLE

N Engl J Med 2005;353:2442-9.

A Predominantly Clonal Multi-Institutional Outbreak of *Clostridium difficile*–Associated Diarrhea with High Morbidity and Mortality

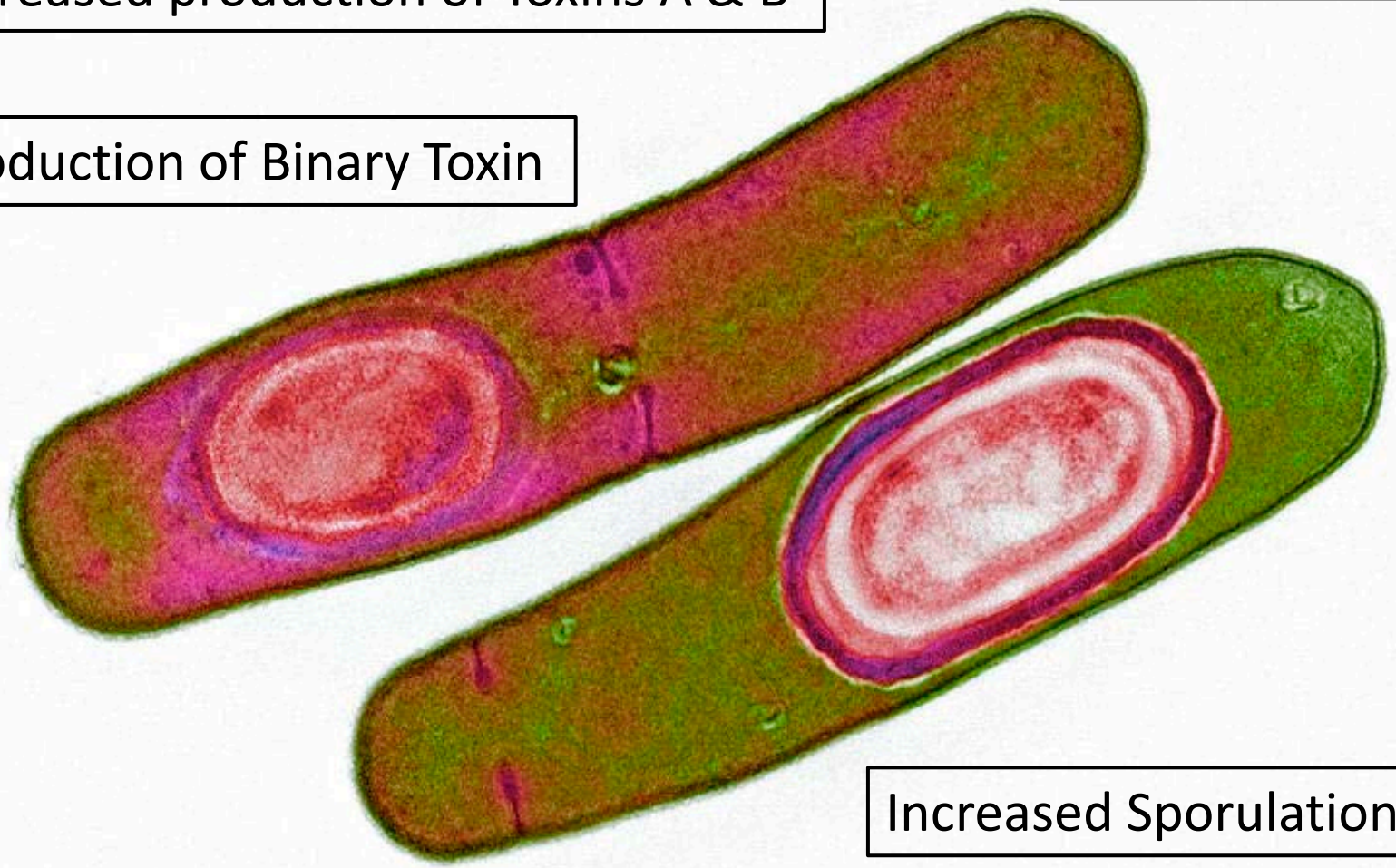
Vivian G. Loo, M.D., Louise Poirier, M.D., Mark A. Miller, M.D., Matthew Oughton, M.D., Michael D. Libman, M.D., Sophie Michaud, M.D., M.P.H., Anne-Marie Bourgault, M.D., Tuyen Nguyen, M.D., Charles Frenette, M.D., Mirabelle Kelly, M.D., Anne Vibien, M.D., Paul Brassard, M.D., Susan Fenn, M.L.T., Ken Dewar, Ph.D., Thomas J. Hudson, M.D., Ruth Horn, M.D., Pierre René, M.D., Yury Monczak, Ph.D., and André Dascal, M.D.

Clonal Outbreak with 1703 cases in 5.5 months
4 x Increase in Incidence – Significant Morbidity and Mortality
Trigger: Cephalosporins and Fluroquinolones

BI/Nap1/027

Increased production of Toxins A & B

Production of Binary Toxin



Increased Sporulation

Fluoroquinolone Resistance

Increased Motility

Where Did it Come From?

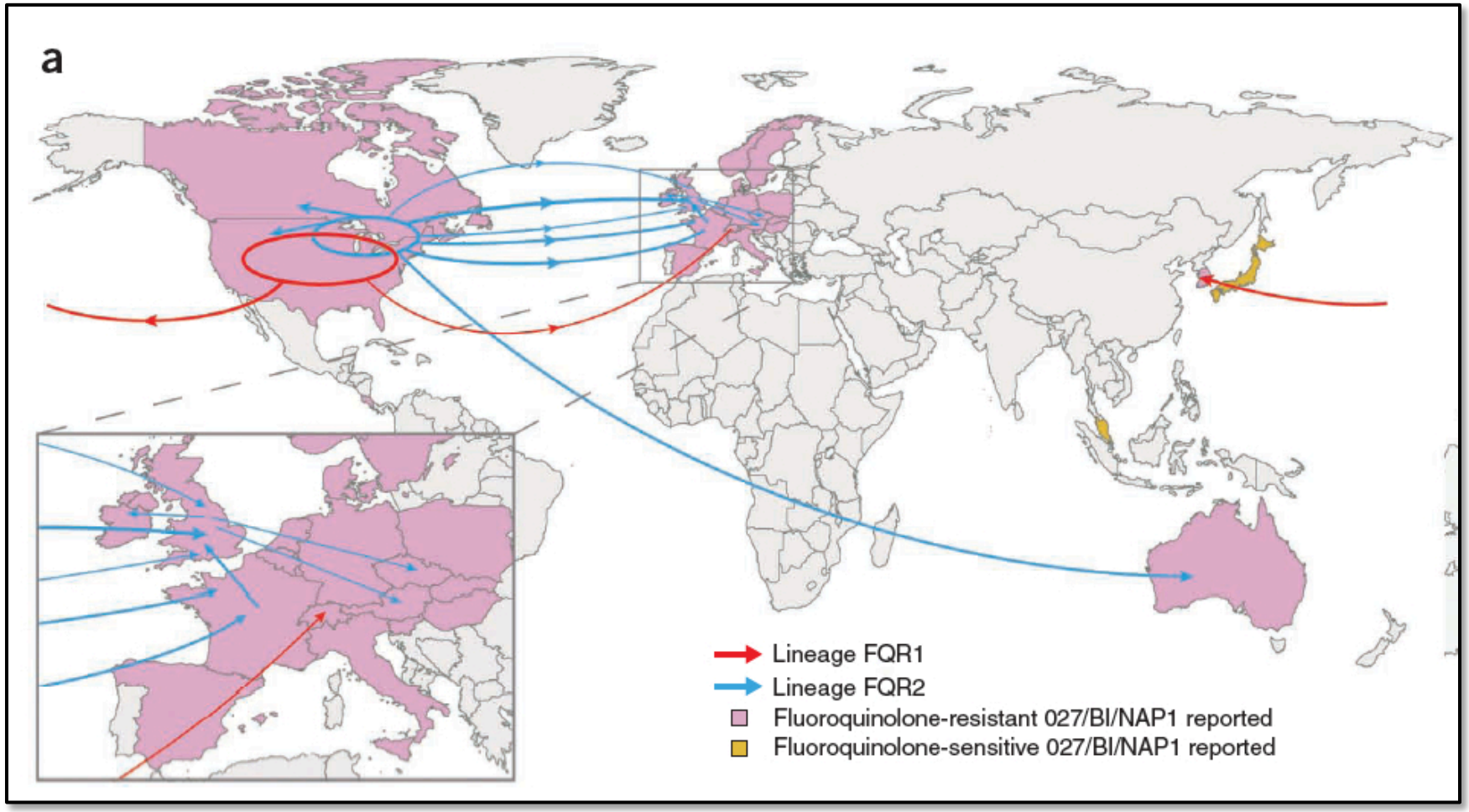
Emergence and global spread of epidemic healthcare-associated *Clostridium difficile*

Miao He[1], Fabio Miyajima[2,3], Paul Roberts[2,3], Louise Ellison[1], Derek J Pickard[1], Melissa J Martin[4], Thomas R Connor[1], Simon R Harris[1], Derek Fairley[5], Kathleen B Bamford[6,7], Stephanie D'Arc[6,7], Jon Brazier[8], Derek Brown[9], John E Coia[9], Gill Douce[9], Dale Gerding[10], Hee Jung Kim[11], Tse Hsien Koh[12], Haru Kato[13], Mitsutoshi Senoh[13], Tom Louie[14], Stephen Michell[15], Emma Butt[15], Sharon J Peacock[1,16–18], Nick M Brown[17,18], Tom Riley[19], Glen Songer[20], Mark Wilcox[21], Munir Pirmohamed[2,3], Ed Kuijper[22], Peter Hawkey[23], Brendan W Wren[4], Gordon Dougan[1], Julian Parkhill[1] & Trevor D Lawley[1]

Whole genome sequencing of 151 strains isolated primarily from hospital patients between 1985-2010

Nature Genetics 2013;45:109-113.

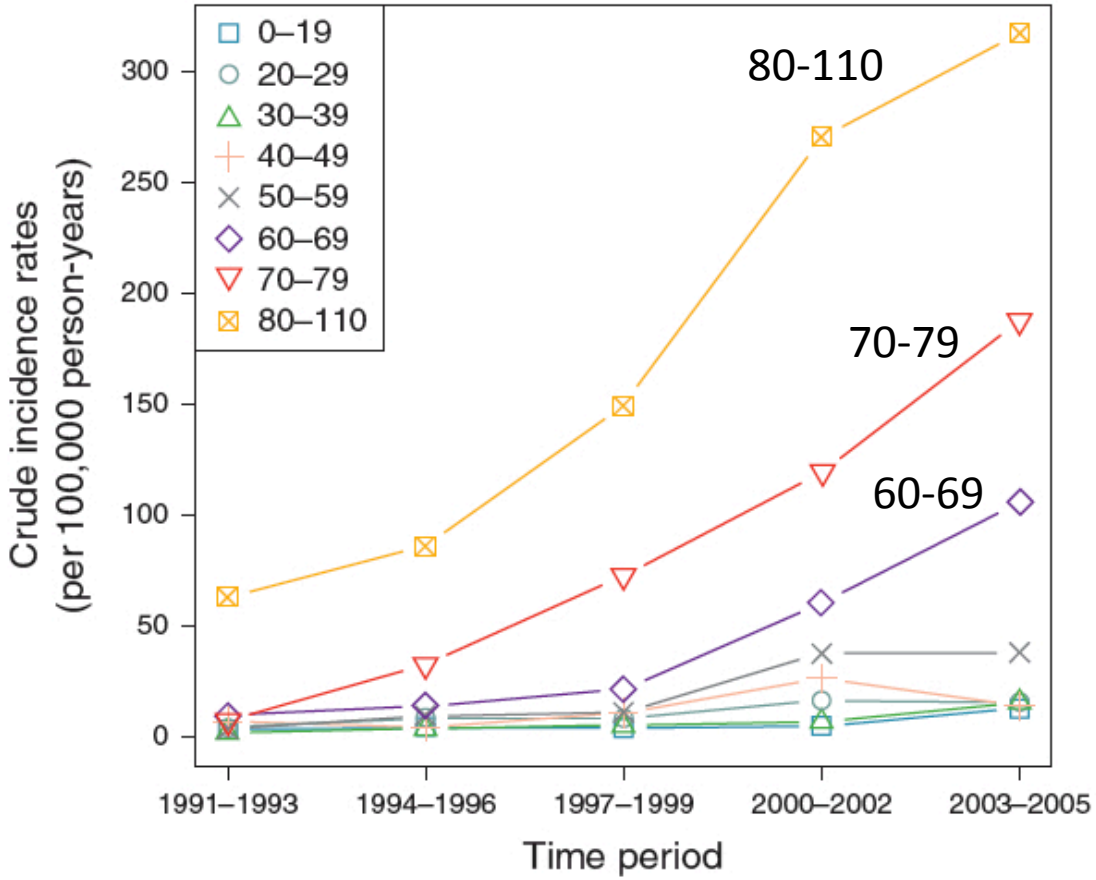
Emergence and Global Spread of Epidemic HCA *C. difficile*



He, M. et al Nature Genetics 2013;45:109-113.

The Epidemiology of Community-Acquired *Clostridium difficile* Infection: A Population-Based Study

Sahil Khanna, MBBS[1], Darrell S. Pardi, MD, MS, FACG[1], Scott L. Aronson, MD[1,2], Patricia P. Kammer, CCRP[1], Robert Orenstein, DO[3], Jennifer L. St Sauver, PhD[4], W. Scott Harmsen, MS[5] and Alan R. Zinsmeister, PhD[5]



- CDI has increased over time
- Age is a risk factor
- **41%** of CDI was Community-Acquired
- **22%** of C-CDI had no antibiotic exposure

Am J Gastroenterol 2012;107:89-95.

Not So Nosocomial Anymore

Not So Nosocomial Anymore: The Growing Threat of Community-Acquired *Clostridium difficile*

Daniel A. Leffler, MS, MD[1] and J. Thomas Lamont, MD[1]

Am J Gastroenterol 2012;107:96-98.

- Community-acquired CDI is increasing
- Where is it coming from?
  - Food and Water?
  - Domestic and farm animals?
- Risk factors for Community-acquired CDI?

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 SEPTEMBER 26, 2013 VOL. 369 NO. 13

Diverse Sources of *C. difficile* Infection Identified on Whole-Genome Sequencing

3.5 yr. study of 1223 patients with *C. difficile* (during a non-outbreak time) - **45%** of isolates are genetically distinct

Diverse Sources must contribute to *C. difficile*:

Asymptomatic shedders; food; water; animals; ???

Eyre D.W. et al. N Engl J Med 2013;369:1195-205.

Major article

Asymptomatic *Clostridium difficile* colonization in a tertiary care hospital: Admission prevalence and risk factors

Surbhi Leekha MBBS, MPH [a,*], Kimberly C. Aronhalt MA, RN [b], Lynne M. Sloan BS [c], Robin Patel MD [c], Robert Orenstein DO [a]

320 Adults Admitted to Acute Care Hospital

31 (9.7%) PCR + for *C. difficile*

Variable	P value
Recent Hospitalization	0.004
Chronic Dialysis	0.007
Proton Pump Inhibitor Use	0.03
Corticosteroid Use	0.02

10% of patients have asymptomatic *C. diff* colonization at hospital admission and 77% have recent healthcare contact as an identifiable risk factor

Am J Infect Control 2013;41:390-393.

Predictors of asymptomatic *Clostridium difficile* colonization on hospital admission

Ling Yuan Kong MD [a], Nandini Dendukuri PhD [a], Ian Schiller MSc [a], Anne-Marie Bourgault MD [a,b], Paul Brassard MD, MSc [a], Louise Poirier MD [b], François Lamothe MD [c], Claire Béliveau MD [b], Sophie Michaud MD, MPH [d], Nathalie Turgeon MD [e], Baldwin Toye MD [f], Eric H. Frost PhD [d], Rodica Gilca MD, PhD [g,h], Andre Dascal MD [i], Vivian G. Loo MD, MSc [a,*]

- 212/5232 (**4.05%**) colonized with *C. difficile*
- Risk Factors:
  - Hospitalization in last 12 mos.
  - Previous CDI
  - Use of Steroids
  - Antibody to Toxin B

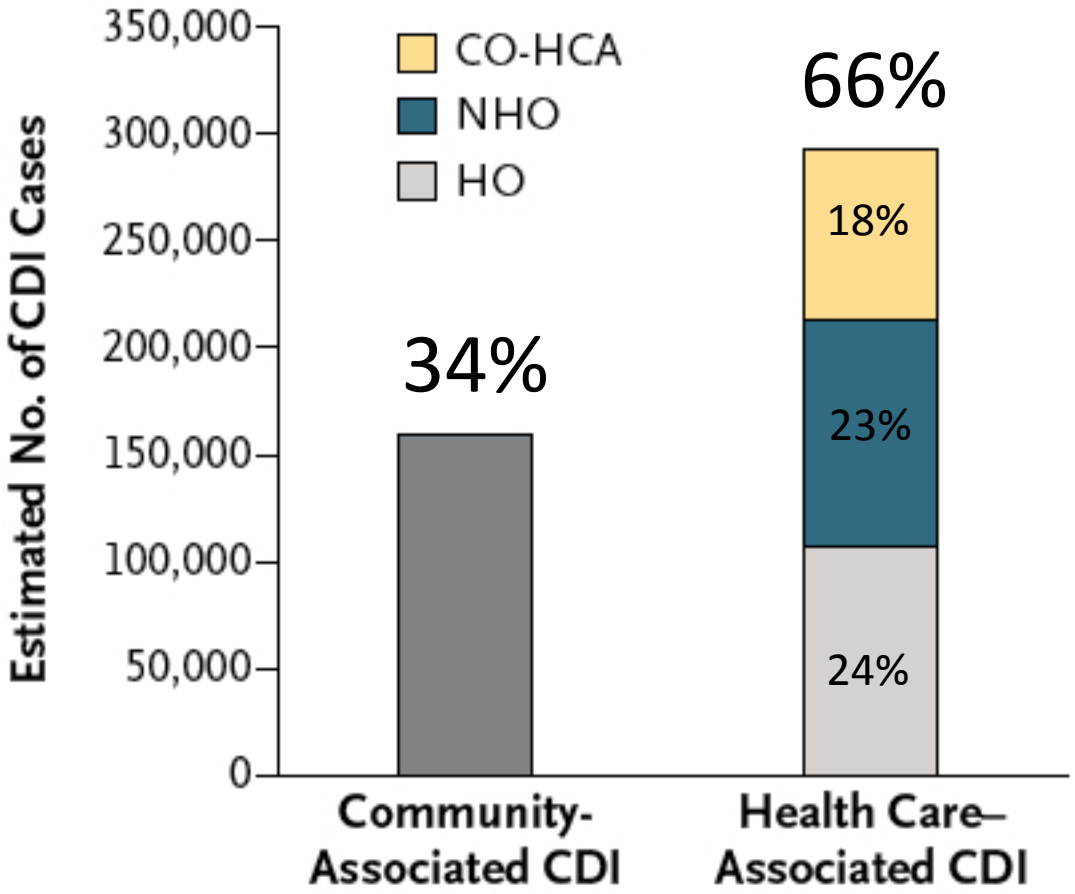
Clinical Risk Factors Can Predict Asymptomatic Carriers

Am J Infect Control 2015;43:248-53.

ORIGINAL ARTICLE

Lessa, F.C. et al N Engl J Med;2015:372:825-34.

Burden of *Clostridium difficile* Infection in the United States



There were nearly

500,000 *C. difficile* infections in the U.S. in 2011 with approximately

29,000 deaths.

75% of CDI occurs outside of hospitals – prevention efforts need to extend beyond the hospital setting.

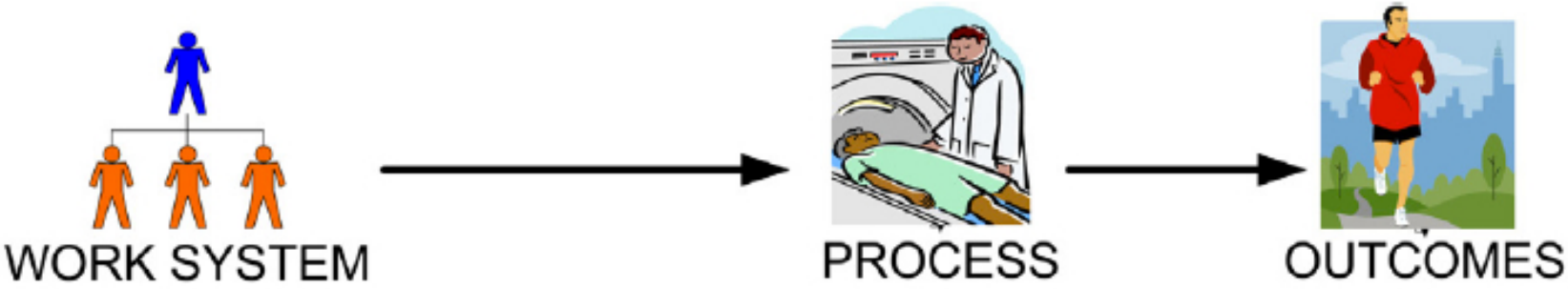
SHEA/IDSA PRACTICE RECOMMENDATION

Strategies to Prevent *Clostridium difficile* Infections in Acute Care Hospitals: 2014 Update

- **Contact Precautions for CDI** (Hand Hygiene III; Gloves II; Gowns III; Single Patient Room III)
- **Ensure cleaning and disinfection of patient equipment (III) and the environment (III)**
- **Appropriate use of antimicrobials (II)**
- Educate HCW's, ES and Administration (III)
- Unresolved: Probiotics; Gastric Acid Suppressants; No Touch Disinfection Technologies

Dubberke, E.A. et al. Infect Control Hosp Epidemiol 2014;35:628-645.

Understanding the current state of infection prevention to prevent *Clostridium difficile* infection: A human factors and systems engineering approach



Poor Compliance with Isolation: Hosp. A - **7%**; Hosp. B - **22%**

Time: **75s** vs **4.5s** (In and Out) – Isolation vs. No-Isolation

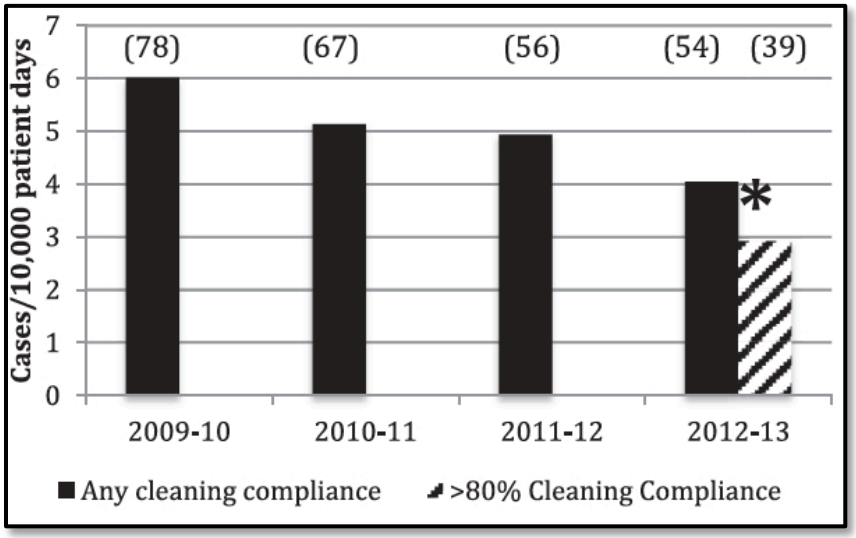
Isolation is complex, multi-step, time-consuming with numerous barriers resulting in poor adherence.

Yanke, E. et al. Am J Infect Control 2015;43:241-7.

Major article

Use of a daily disinfectant cleaner instead of a daily cleaner reduced hospital-acquired infection rates

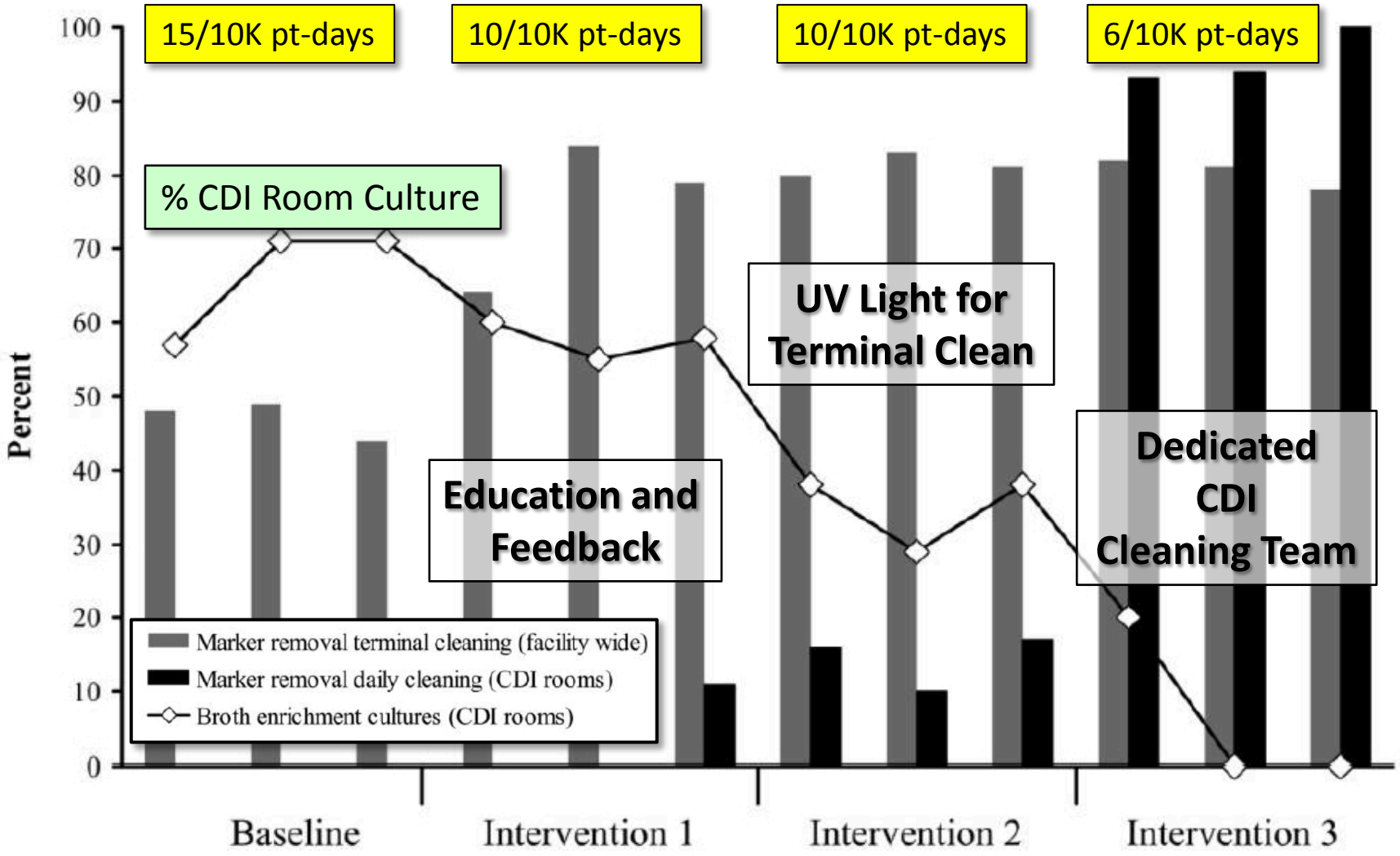
Michelle J. Alfa PhD [a,b,*], Evelyn Lo MD [b,c], Nancy Olson BSc [a], Michelle MacRae [c], Louise Buelow-Smith RN [c]



- Reduction in CDI from 6 to 3/10,000pd required:
  - Dedicated trained Hskp
  - Monitoring & Feedback
  - Switch to Sporicidal Disinfectant Product (accelerated H_2O_2) for all high touch surfaces

Am J Infect Control 2015;43:141-6.

Sequential Cleaning Interventions to Reduce CDI



Sitzlar, B. et al. Infect Control Hosp Epidemiol 2013;34:459-465.

No Touch Disinfection – UV Systems

The Torch

Sterilray

Surfacide

IRIS

Tru-D

Aseptix 2

UVDI

Xenex

No Touch Disinfection – H_2O_2 Systems

Glosair (aHP)

Bioquell*
H_2O_2 Vapour

Nocospray (aHP)

Steris H_2O_2 Vapour*

AsepticSure*
3% H_2O_2 /50-500ppm Ozone

NATIONAL POST

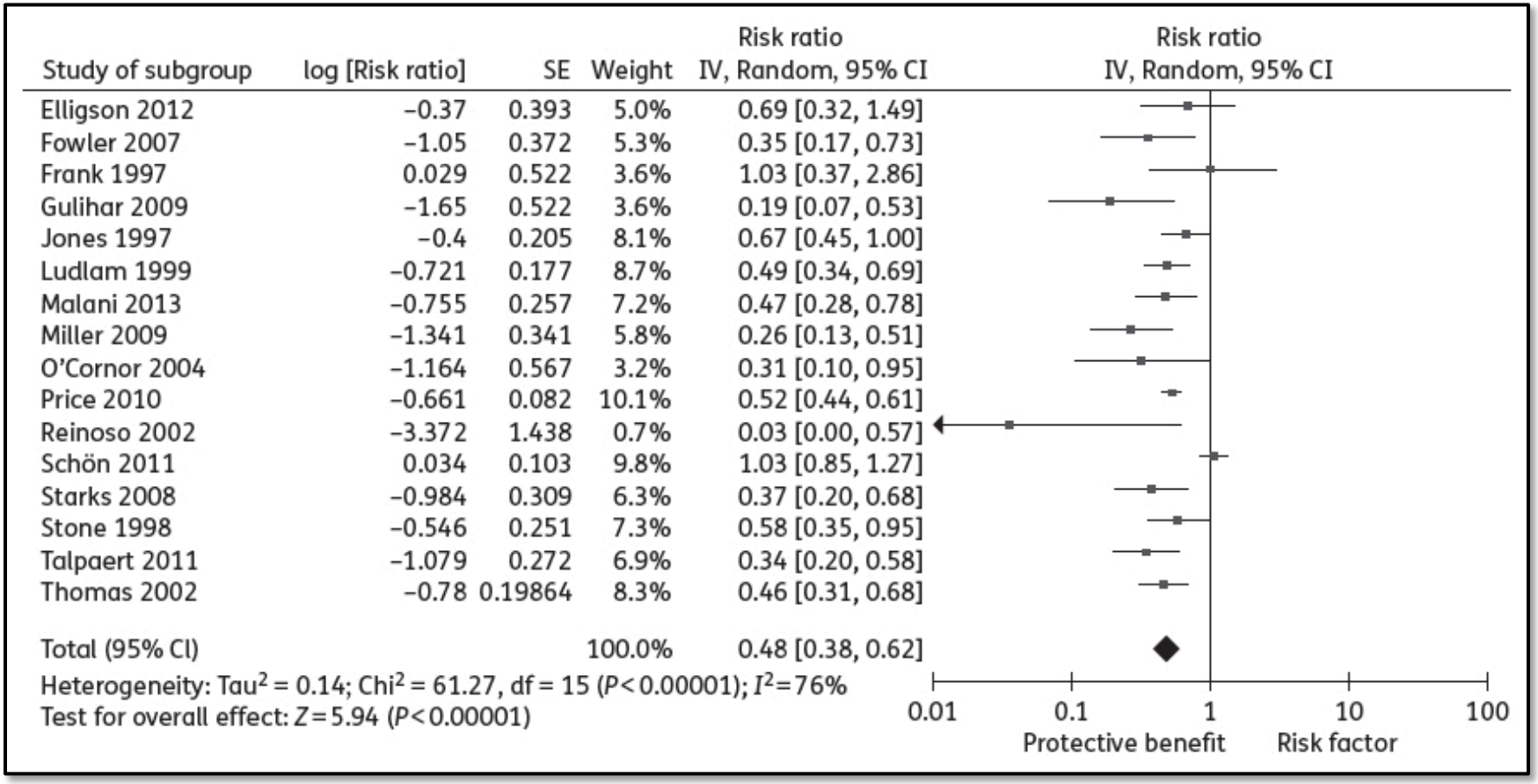
New Canadian disinfection system could be key to winning war on superbugs that kill thousands

Tom Blackwell January 26, 2014

“This changes the game,” said Dr. Dick Zoutman, a Queen’s University infectious-disease specialist and co-inventor of the AsepticSure technology. “The room is effectively germ free. Now I can say to a patient — after 30 years of being in the infectious-disease business — ‘Welcome to your room, this room is safe, it’s really safe.’

Antibiotic Stewardship Reduces CDI

Overall Risk Reduction of 52%

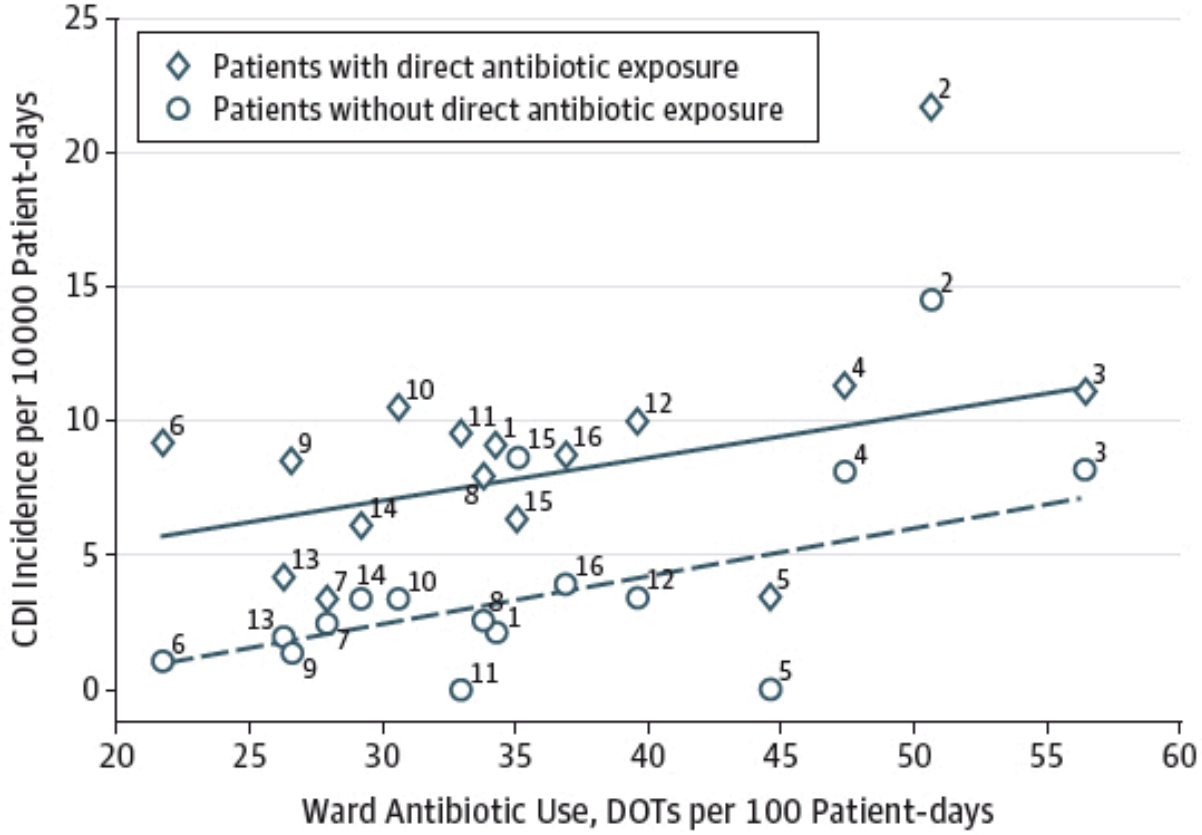


Feazel, L.M., et al. J Antimicrob Chemother 2014;69:1748-1754.

Original Investigation | LESS IS MORE

Hospital Ward Antibiotic Prescribing and the Risks of *Clostridium difficile* Infection

Kevin Brown, PhD; Kim Valenta, PhD; David Fisman, MD, MSc; Andrew Simor, MD; Nick Daneman, MD, MSc



Risk of CDI increases 34% for each 10% increase in overall ward use of Antibiotic, for both those who receive and don't receive antibiotic treatment.

JAMA Intern Med 2015;175:626-633.

By altering the **microbiomes** of a subset of patients on a hospital ward, Antibiotics put the entire population (including those who do receive antibiotics) at increased risk via increased transmission. This could be important for VRE, CRE and other MDRO's, as well as *C. diff* and highlights the need for improved stewardship.

McDonald, L.C. JAMA Intern Med 2015;175:633-634.

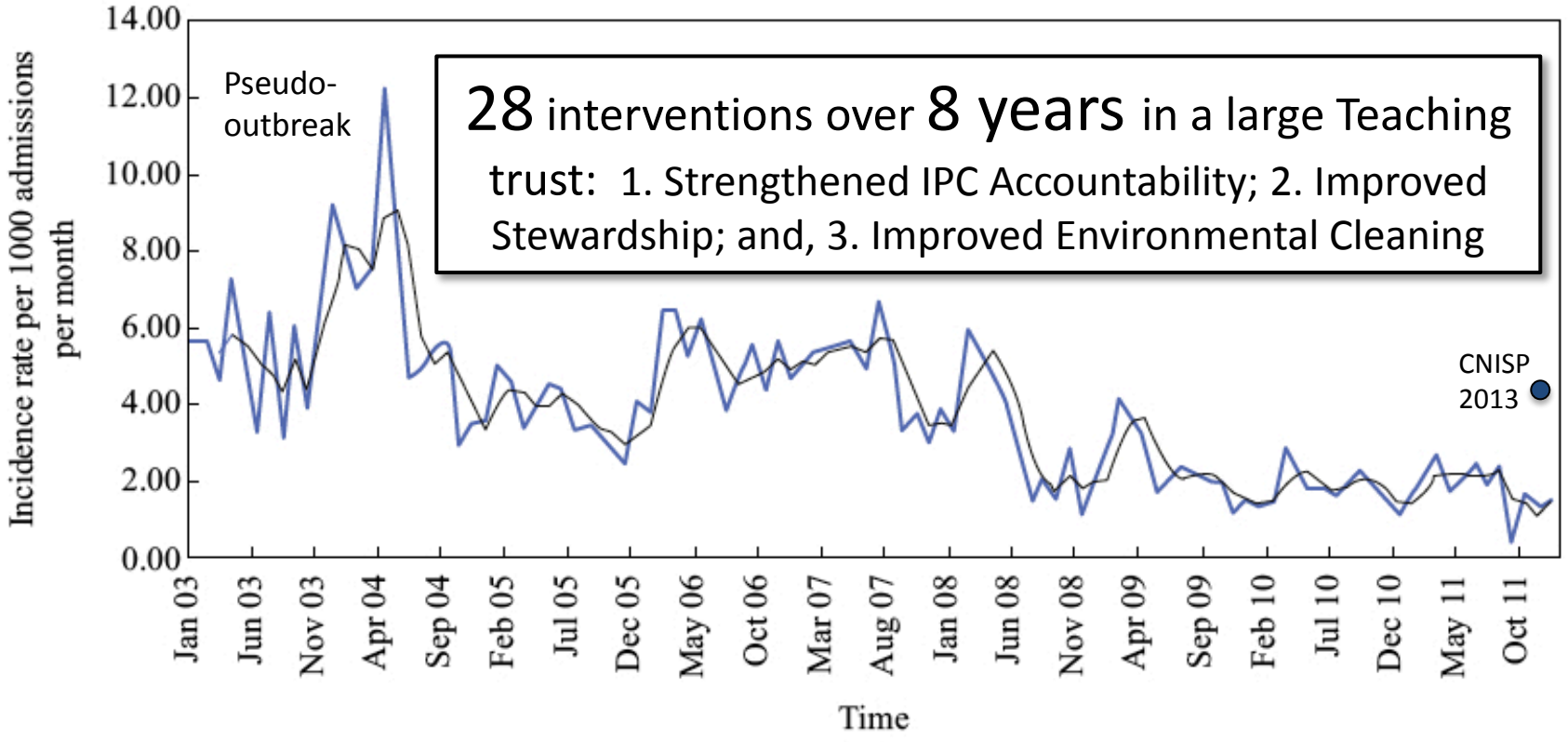
The Cesspool Effect

Dr. Tom Louie

Maybe Stewardship Really is the Answer?

Analysis of interventions to reduce the incidence of *Clostridium difficile* infection at a London teaching hospital trust, 2003–2011

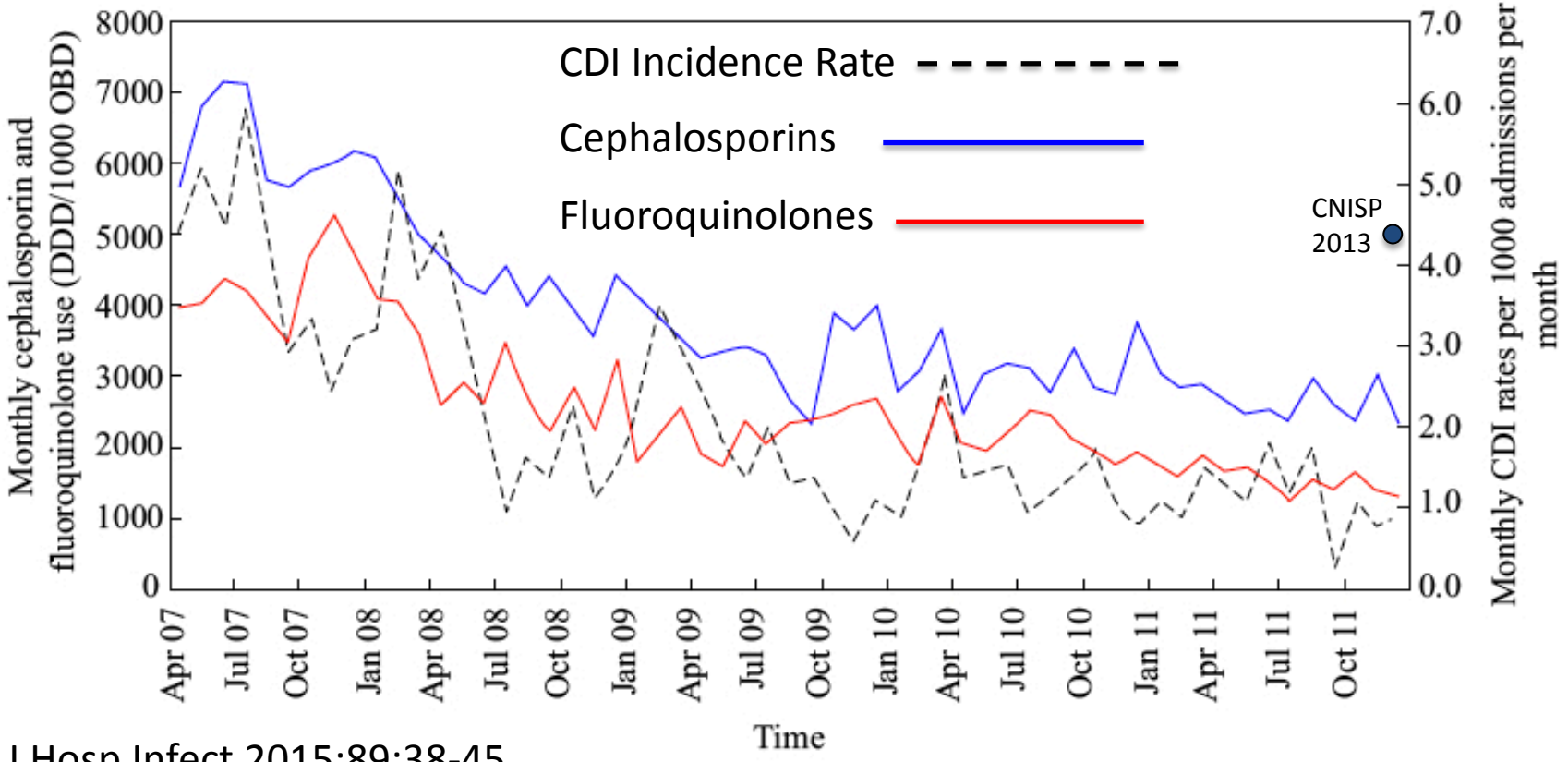
O. Marufu [a], N. Desai [a], D. Aldred [b], T. Brown [b], I. Eltringham [a,*]



J Hosp Infect 2015;89:38-45.

Analysis of interventions to reduce the incidence of *Clostridium difficile* infection at a London teaching hospital trust, 2003–2011

O. Marufu [a], N. Desai [a], D. Aldred [b], T. Brown [b], I. Eltringham [a,*]

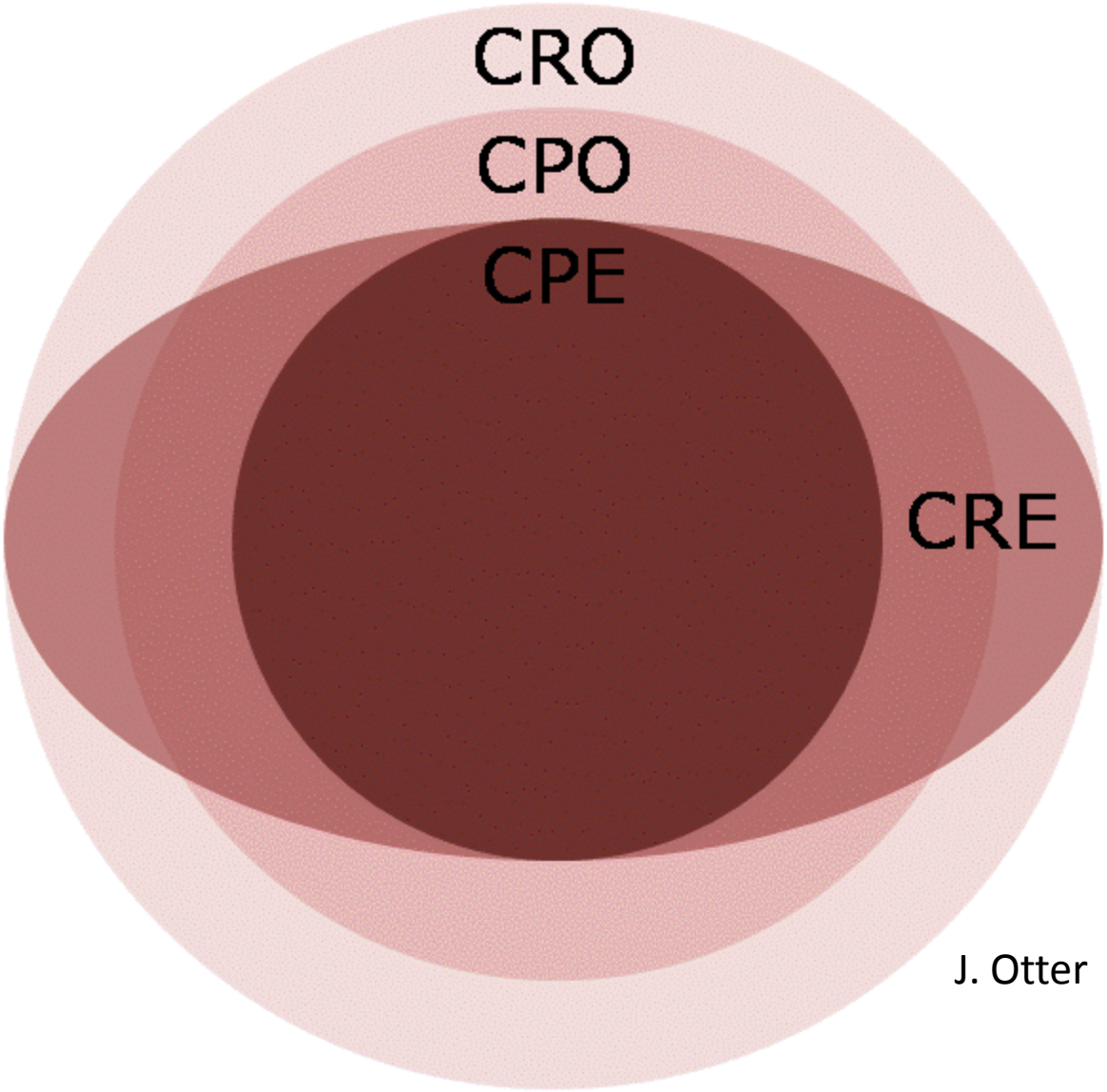


J Hosp Infect 2015;89:38-45.

CRE - URGENT

U.S. CDC Antibiotic Resistance Threats, April 2013

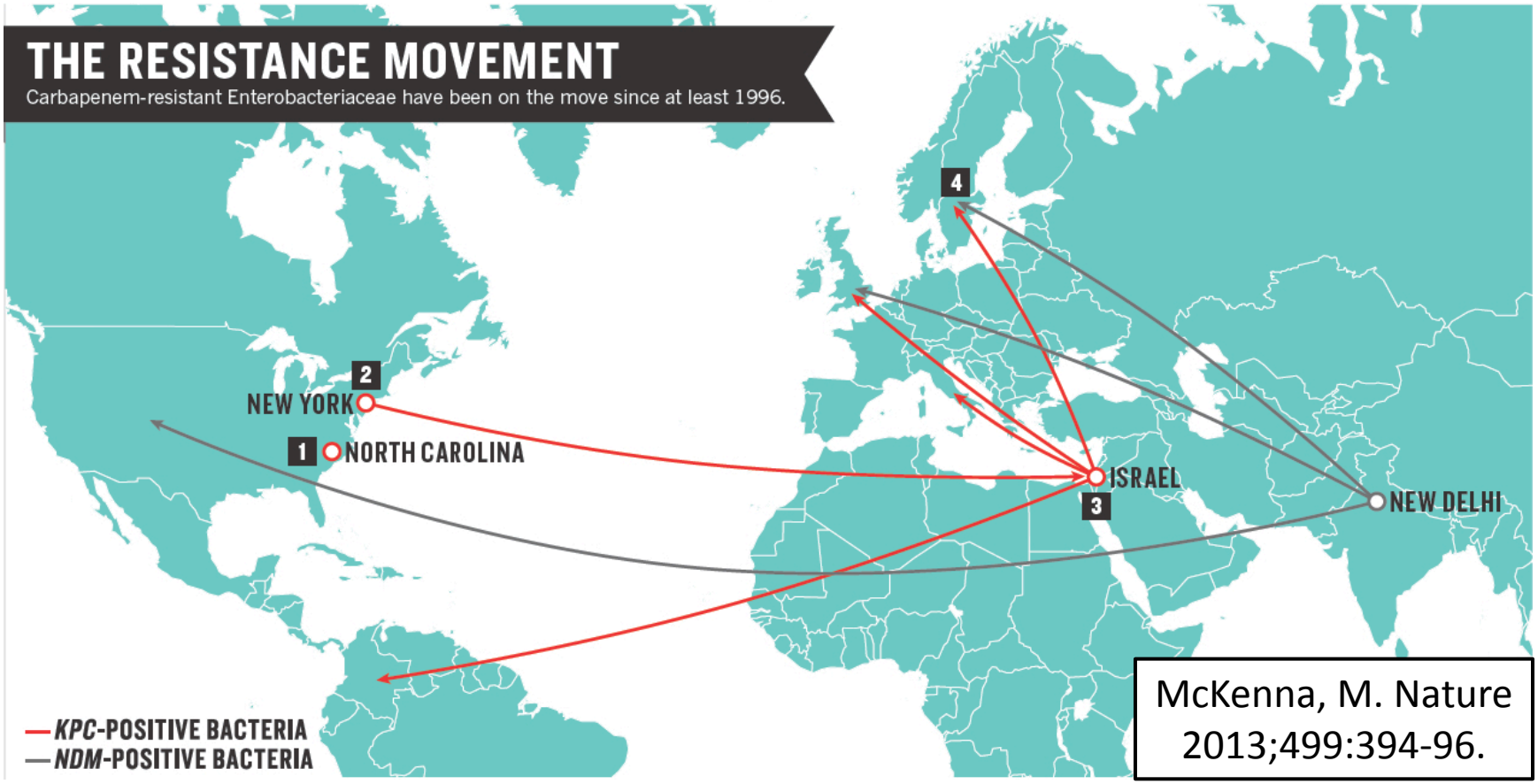
"CRE HAVE BECOME RESISTANT TO ALL OR NEARLY ALL AVAILABLE ANTIBIOTICS"



J. Otter

Confusion in Terminology

THE LAST RESORT



McKenna, M. Nature 2013;499:394-96.

Chicago Tribune

Drug-resistant bacterium raises alarms in Chicago

Superbug resistant to most antibiotics, even the strongest

By Judith Graham, Tribune reporter Oct. 22, 2010

A dangerous, often deadly bacterium resistant to the most powerful antibiotics known to medicine is spreading in Chicago Hospitals and Nursing Homes

CASE REPORT

New Delhi metallo-β-lactamase-1: local acquisition in Ontario, Canada, and challenges in detection

Julianne V. Kus PhD, Manal Tadros MBBS PhD, Andrew Simor MD, Donald E. Low MD, Allison J. McGeer MSc MD, Barbara M. Willey ART, Cindy Larocque MLT, Karen Pike MLT, Iris-Ann Edwards MLT, Helen Dedier MLT, Roberto Melano PhD, David A. Boyd MSc, Michael R. Mulvey PhD, Lisa Louie ART, Christopher Okeahialam MSc CIC, Mark Bayley MD, Cynthia Whitehead MScCH MD, Denyse Richardson MEd MD, Lesley Carr MD, Fatema Jinnah MBBS MSc, Susan M. Poutanen MD MPH

CMAJ 2011;183:1257-1261.

Superbug NDM-1 identified in Canada

Global News: Monday, May 30, 2011

THE VANCOUVER SUN

Fraser Health struggles with superbug outbreak, overcrowding

BY ERIN ELLIS AND TARA CARMAN, VANCOUVER SUN Feb. 4, 2014

"…an outbreak of carbapenemase-producing enterobacteriaceae (CPE) was declared after the usual methods for controlling its spread — strict hand washing and dedicated medical equipment — were not effective."

CBCnews

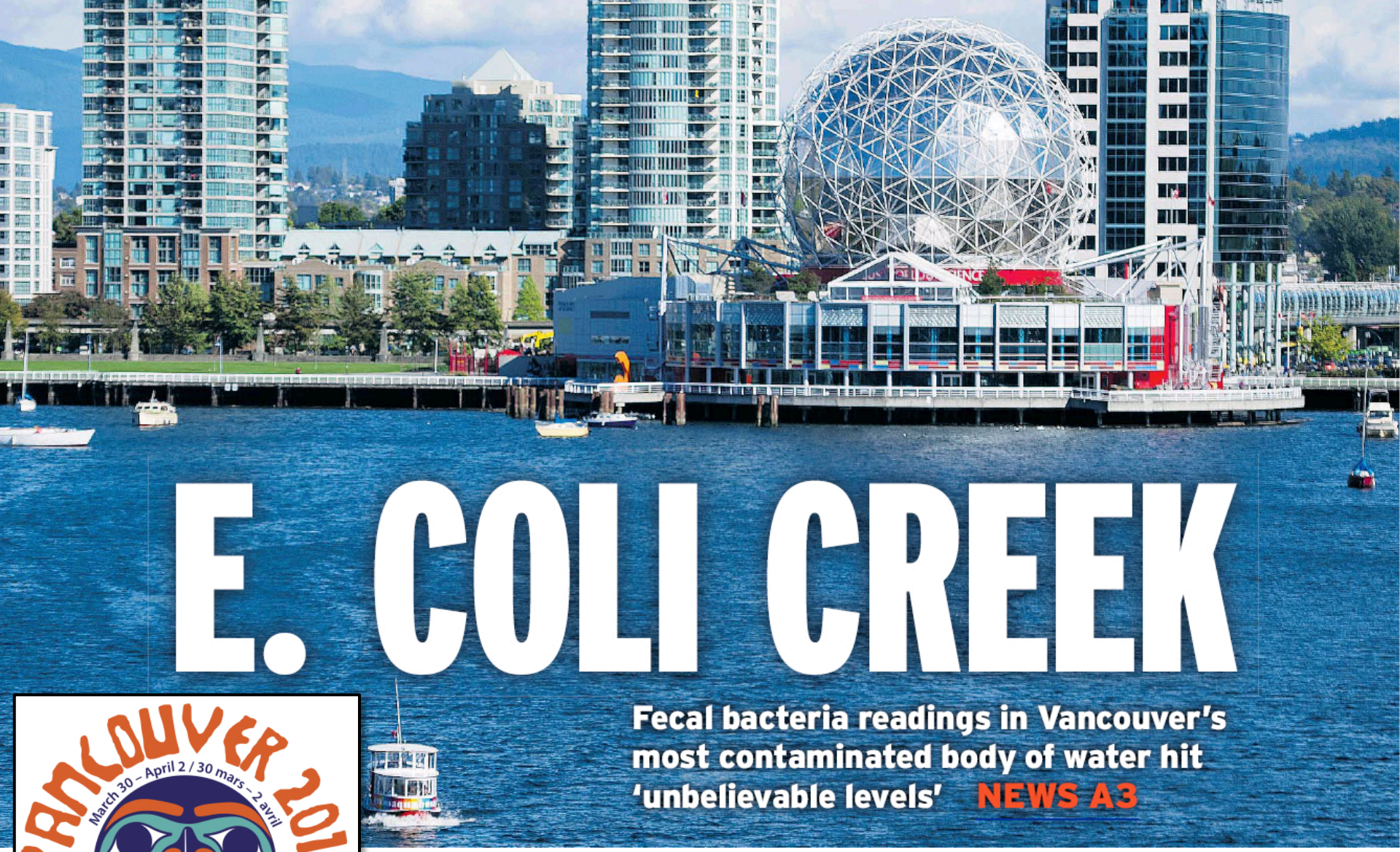
Nov 17, 2014

Antibiotic resistance poses 'alarming' health threat in Europe

Gaps in superbug surveillance 'like we're flying with an eye patch on and mud-splattered goggles'

Surveillance Gaps

http://www.cbc.ca/news/health/antibiotic-resistance-poses-alarming-health-threat-in-europe-1.2838268



VANCOUVER 2016
March 30 – April 2 / 30 mars – 2 avril
AMMI CANADA – CACMID
ANNUAL CONFERENCE | CONFÉRENCE ANNUELLE

Vancouver Province October 1, 2014

BBC News Sport

NEWS US & CANADA

19 February 2015

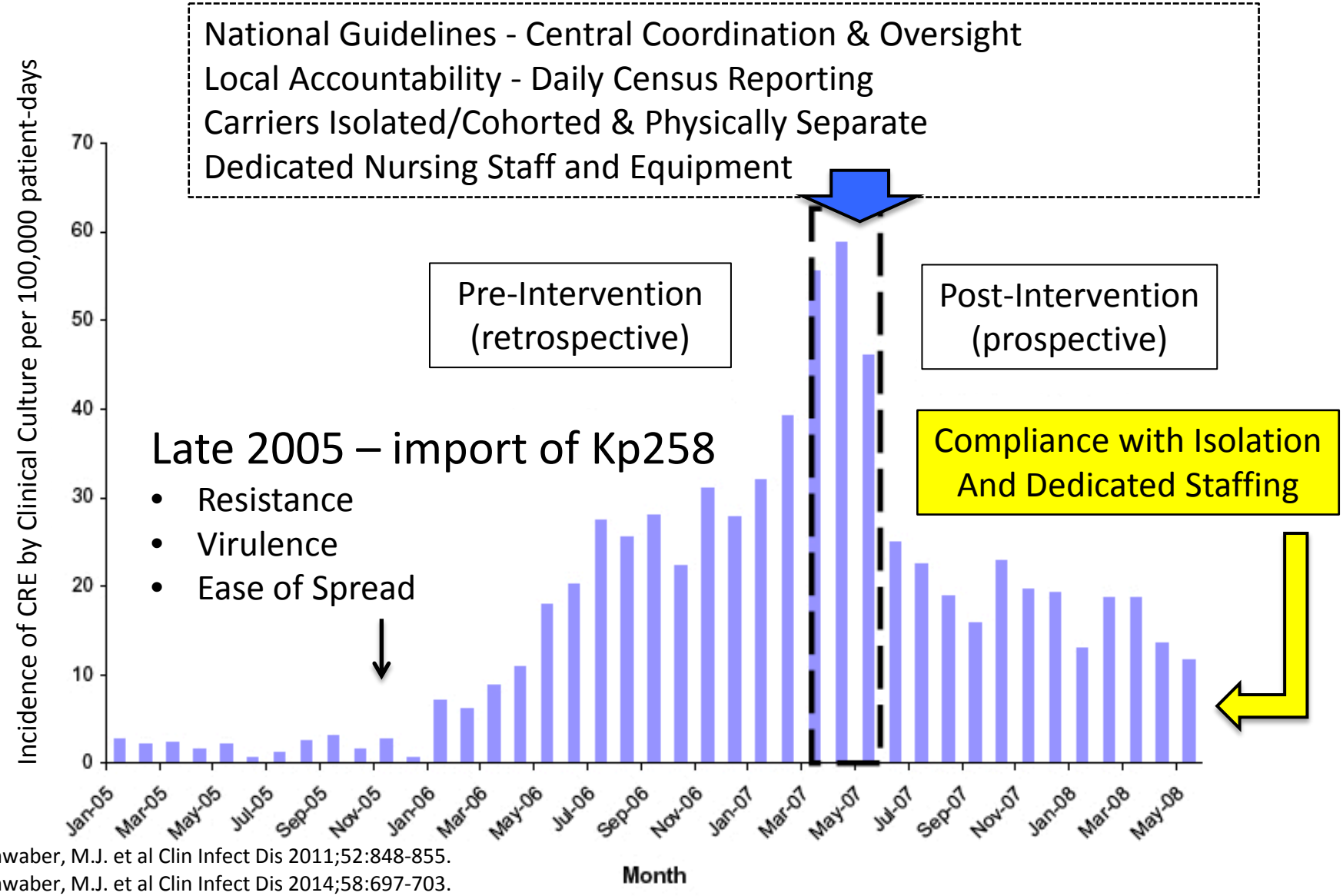
LA hospital superbug: Dozens may have been exposed

Nearly 180 people at a Los Angeles hospital may have been exposed to a deadly strain of bacteria from contaminated medical equipment.

Two deaths at UCLA Medical Center have been linked to the case and seven others are being treated.

http://www.bbc.com/news/world-us-canada-31537617

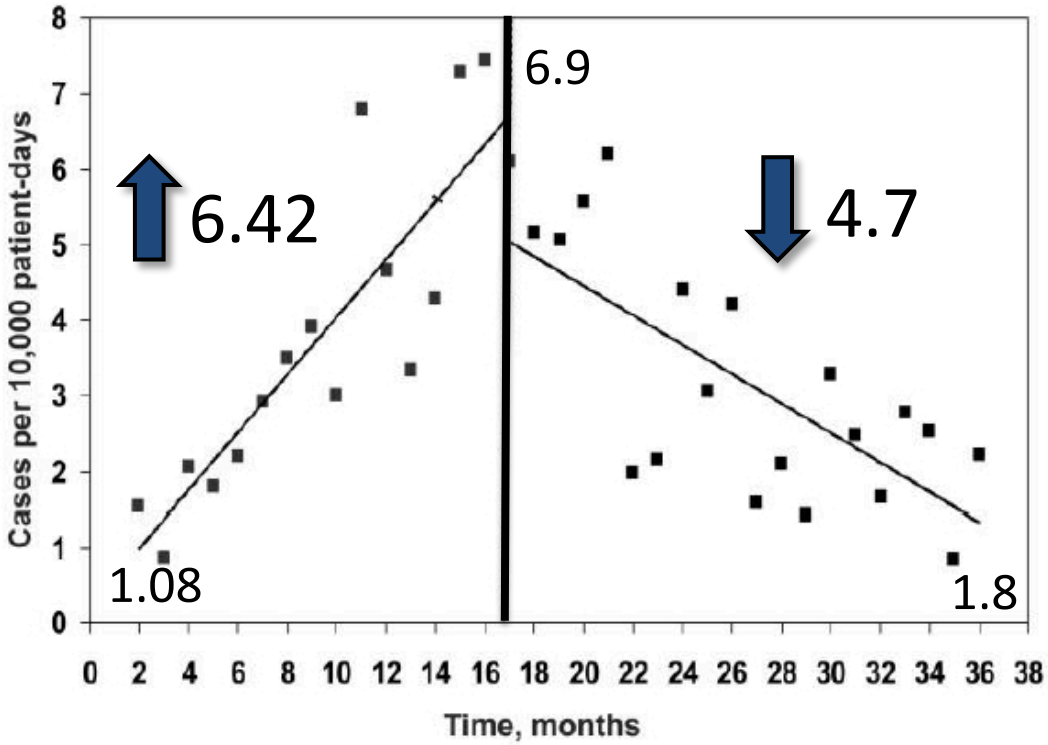
National KPC Outbreak in Israel



Schwaber, M.J. et al Clin Infect Dis 2011;52:848-855.
Schwaber, M.J. et al Clin Infect Dis 2014;58:697-703.

Potential Role of Active Surveillance in the Control of a Hospital-Wide Outbreak of Carbapenem-Resistant *Klebsiella pneumoniae* Infection

Ben-David, D. et al. Infect Control Hosp Epidemiol 2010;31:620-626



Jan. 2006 — June 2007 — Dec 2008

17 mos — 19 mos

Intervention =
Active Surveillance Cultures
+ Contact Isolation

52% of patients were detected by ASC

Israeli National Guidelines for CRE

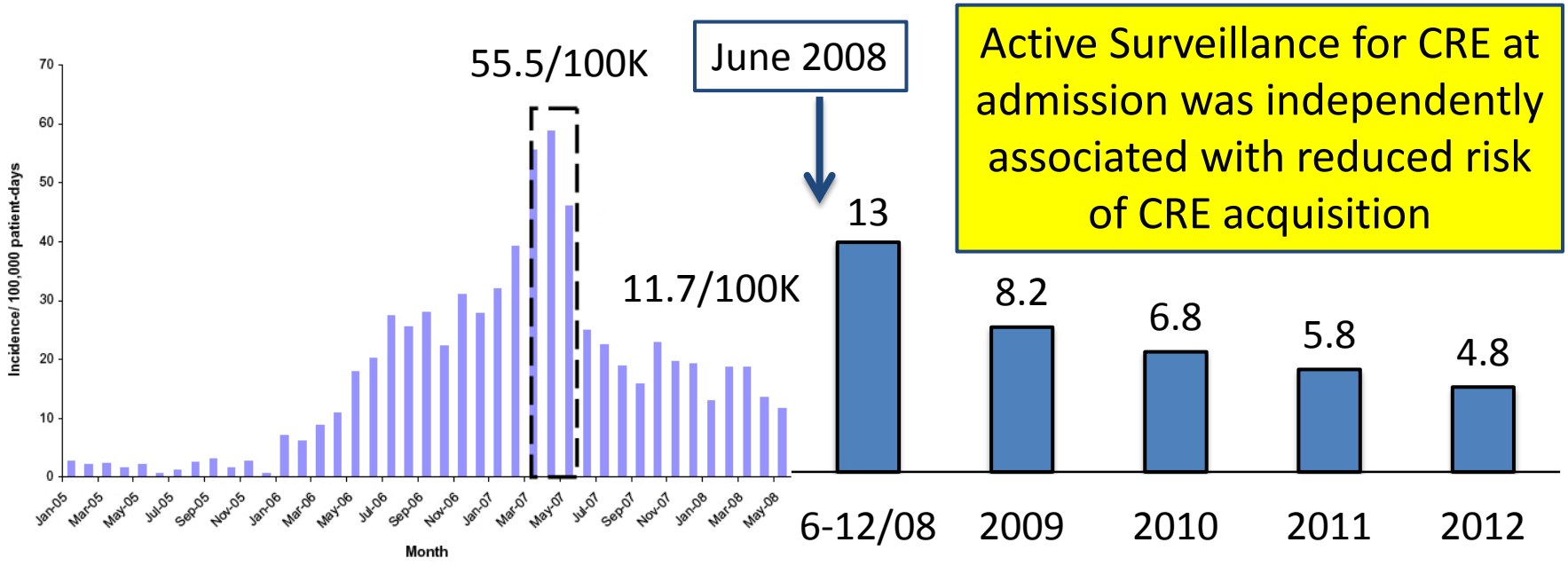
Previously hospitalized patients, LTCF's, LTACH's and Rehabilitation Hospitals become a Reservoir

Variable	Acute care hospitals	Post-acute care hospitals	
		Skilled nursing/chronic ventilated/subacute wards	Rehabilitation wards
Room assignment	Private or cohorting with other CRE carriers	Private or cohorting with other CRE carriers	No regulation regarding room assignment
Dedicated nursing staff for CRE carriers	Required	Not required	Not required
Use of gloves and gowns in care of CRE carriers	Mandatory on room entrance	Mandatory on room entrance	According to standard precautions
Admission CRE screening of high-risk groups[a]	Required	Required	Not required, except in outbreak setting
CRE screening of patient contacts	Required	Required	Required
Participation in group activities	Prohibited	Allowed	Allowed
Standard protocol for discontinuation of contact isolation	Yes	Yes	Yes
Regular mandatory census reporting to NCIC	Yes	Yes	Yes

Ben-David, D. et al. Infect Control Hosp Epidemiol 2014;35:802-809.

National KPC Outbreak in Israel

National Guidelines expand - LTCF's, LTACF's, and Rehab; Active Surveillance for CRE Carriage by Rectal Swab of all contacts (concentric circle model), all transfers, all patients from wards with high rates of CRE – results within 24h to guide isolation

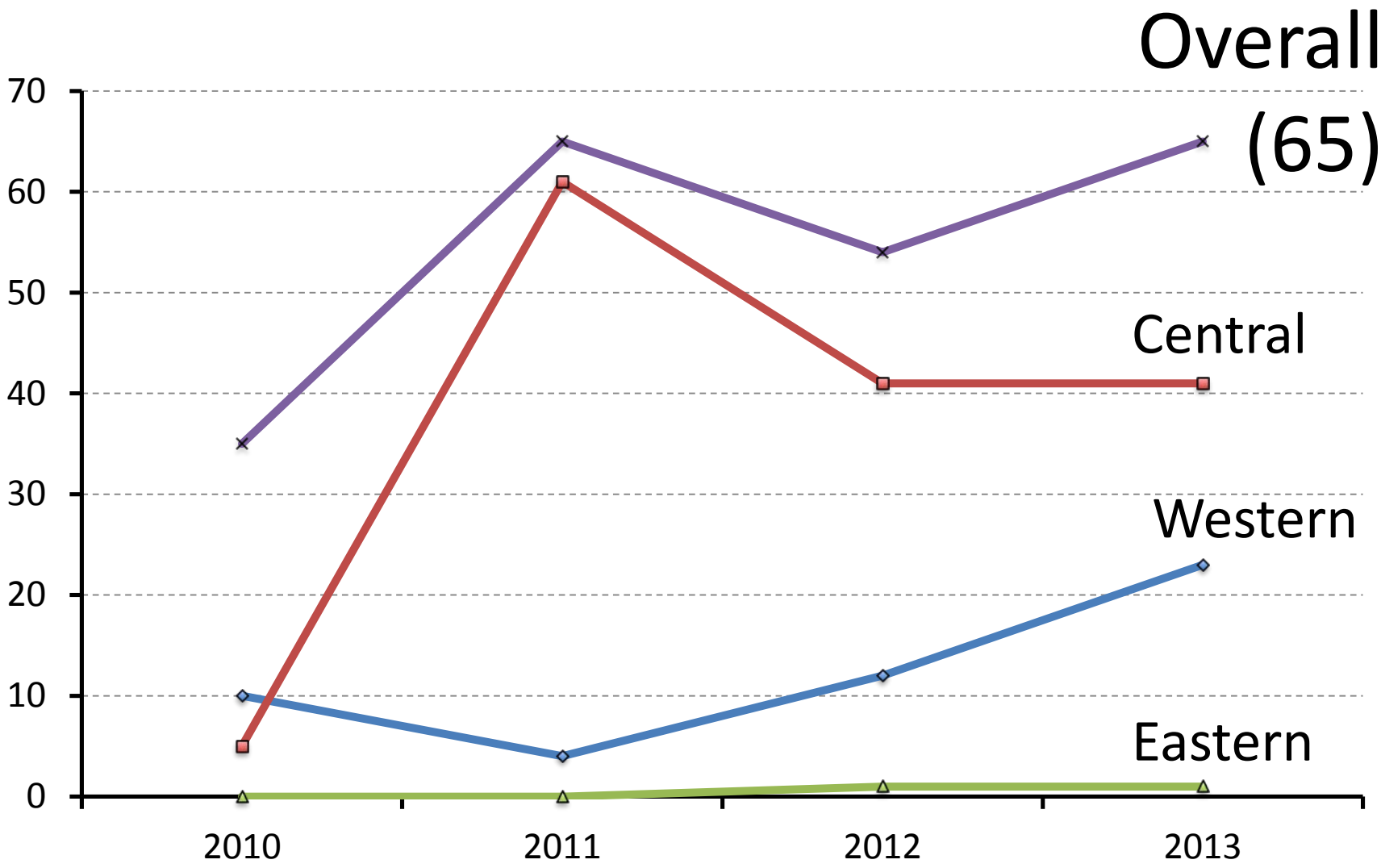


Schwaber, M.J. et al Clin Infect Dis 2014;58:697-703.

The Israeli experience should serve as a **warning** to nations in which CRE is still rare or absent to be alert and prepared for its appearance, with a centralized plan for detection and isolation in place.

Schwaber, M.J. et al Clin Infect Dis 2014;58:697-703.

CPO's in Canada – Number of Cases 2010-2013



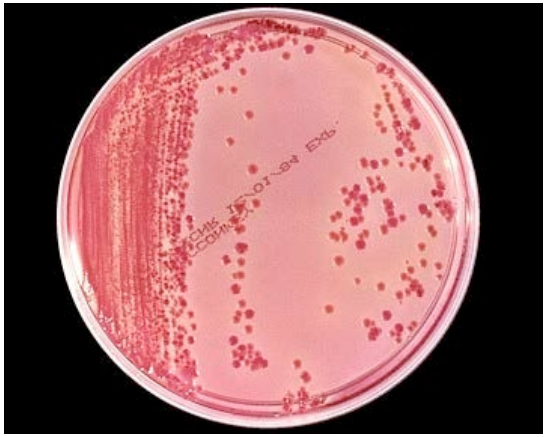
CNISP ARO Surveillance Report January 2015

CPO = Carbapenemase-producing organisms

The Washington Post

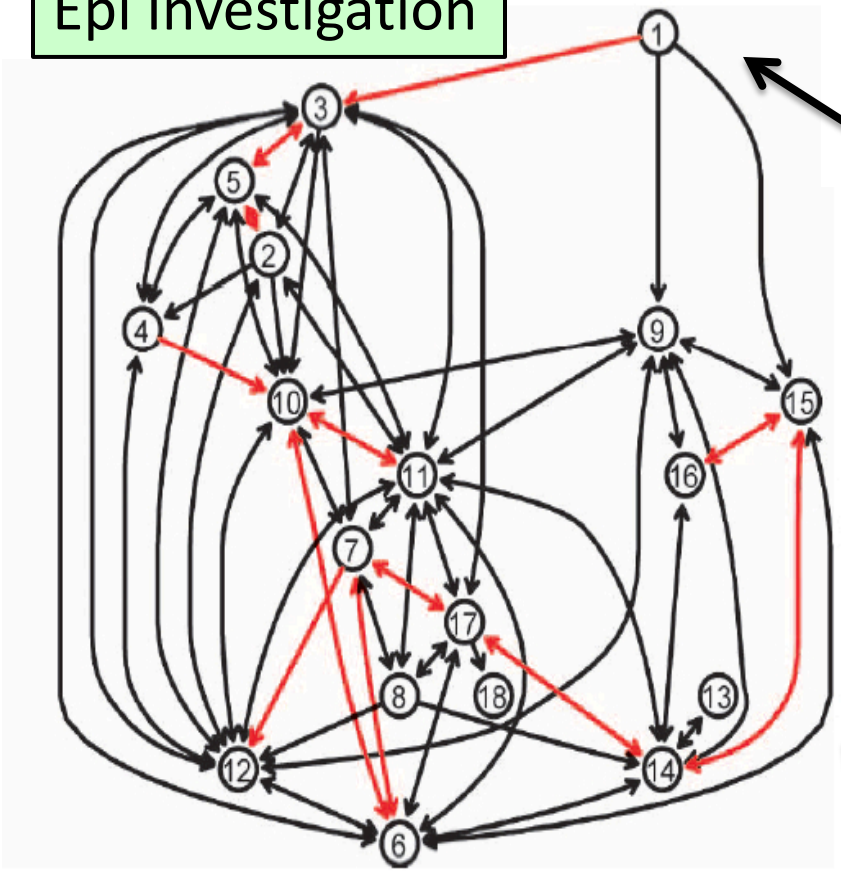
‘Superbug’ stalked NIH hospital last year, killing six

By Brian Vastag
Wednesday, August 22, 2012



Possible Transmission Routes in NIH KPC Outbreak

Epi Investigation



Clonal outbreak of *Klebsiella pneumoniae* ST258

Index patient known to be colonized and isolated at admission

Discharged 3 weeks prior to the second case being recognized

18 patients over 6 months
Death directly related to KPC in 6

Snitkin, E.S. Science Translational Medicine 2012;4:1-9

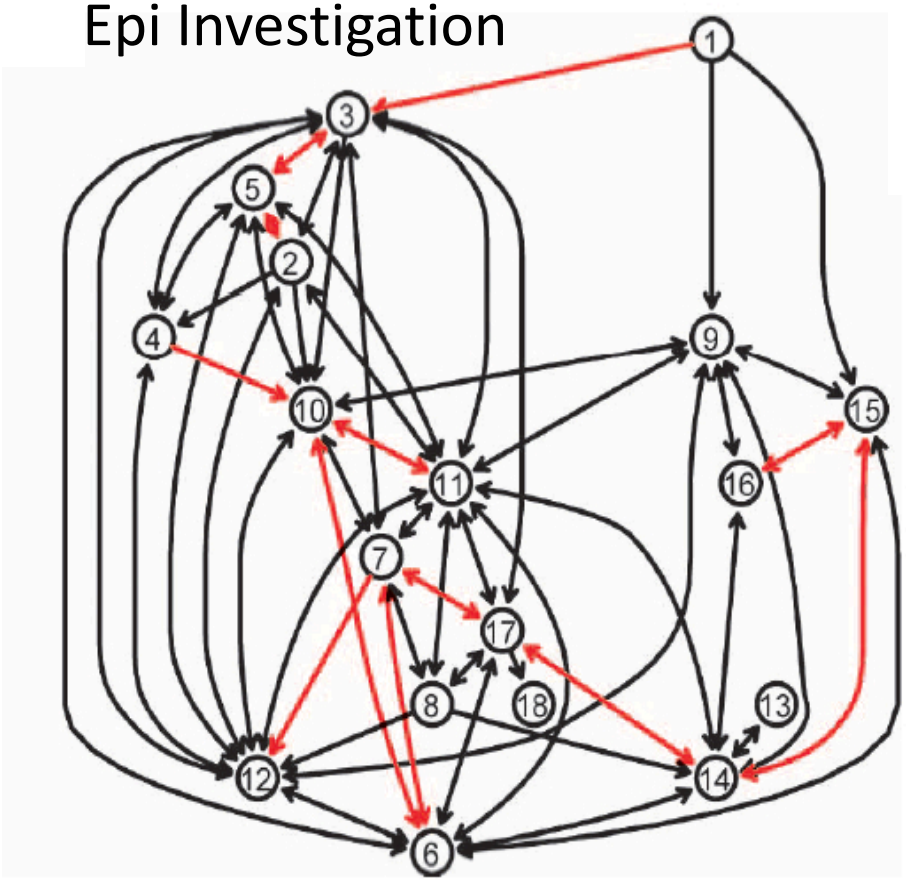
Control Strategies

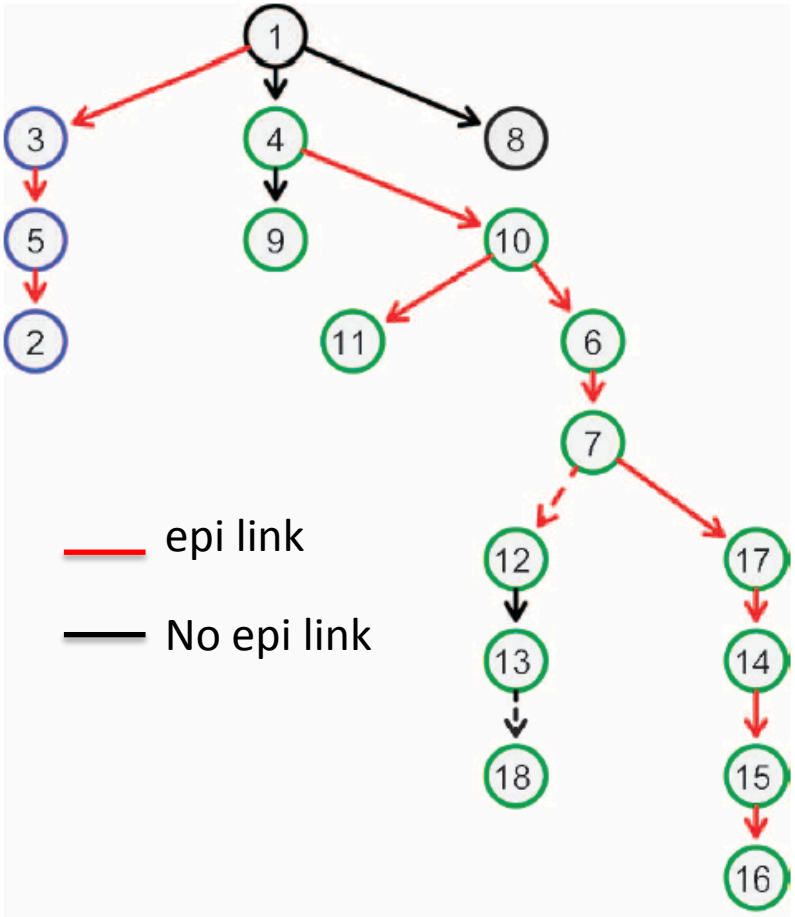
1. Strict enhanced contact precautions for all patients (universal gloves/gowns for entry)
2. Cohorting of patients and staff (including ICU)
3. 24/7 monitoring of IPC precautions
4. Dedicated equipment (Extensive cleaning if shared)
5. Double cleaning of vacated rooms with bleach
6. Terminal cleans with Hydrogen Peroxide vapor
7. Active surveillance cultures in ICU and wards

NIH KPC Outbreak - ?? Transmission Routes

+ Whole Genome Sequencing

Epi Investigation





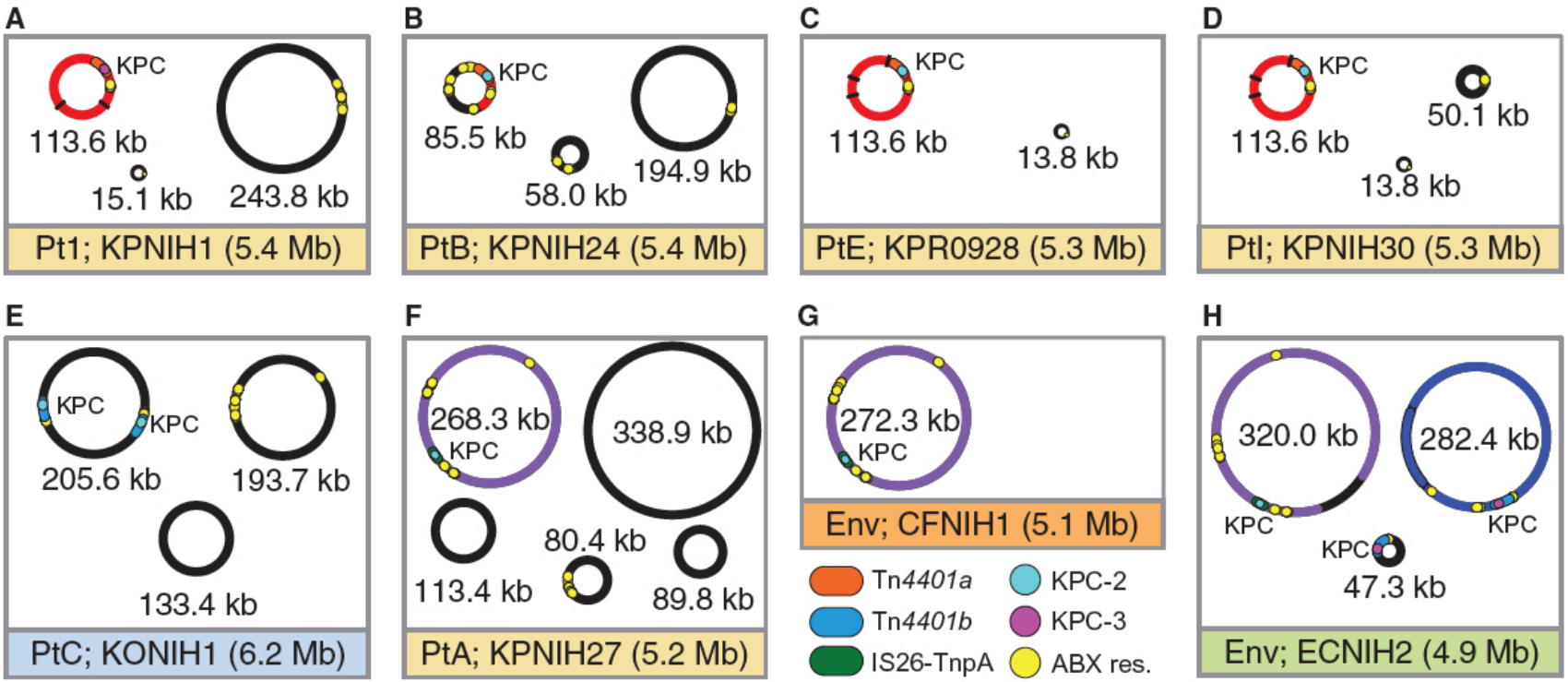
Snitkin, E.S. Science Translational Medicine 2012;4:1-9

NIH Follow-up – Active Surveillance

- Perirectal and/or throat/groin swabs twice weekly from ICU and high risk wards
- July 2012 - All transfers from other facilities had surveillance cultures for 2 consecutive days with pre-emptive isolation until clear
- September 2013 - Admission surveillance cultures for all patients
- Cohorting patients and staff with KPC

ANTIBIOTIC RESISTANCE

Single-molecule sequencing to track plasmid diversity of hospital-associated carbapenemase-producing Enterobacteriaceae



Conlan, S. et al. Sci Transl Med 6, 254ra126 (2014)

ANTIBIOTIC RESISTANCE

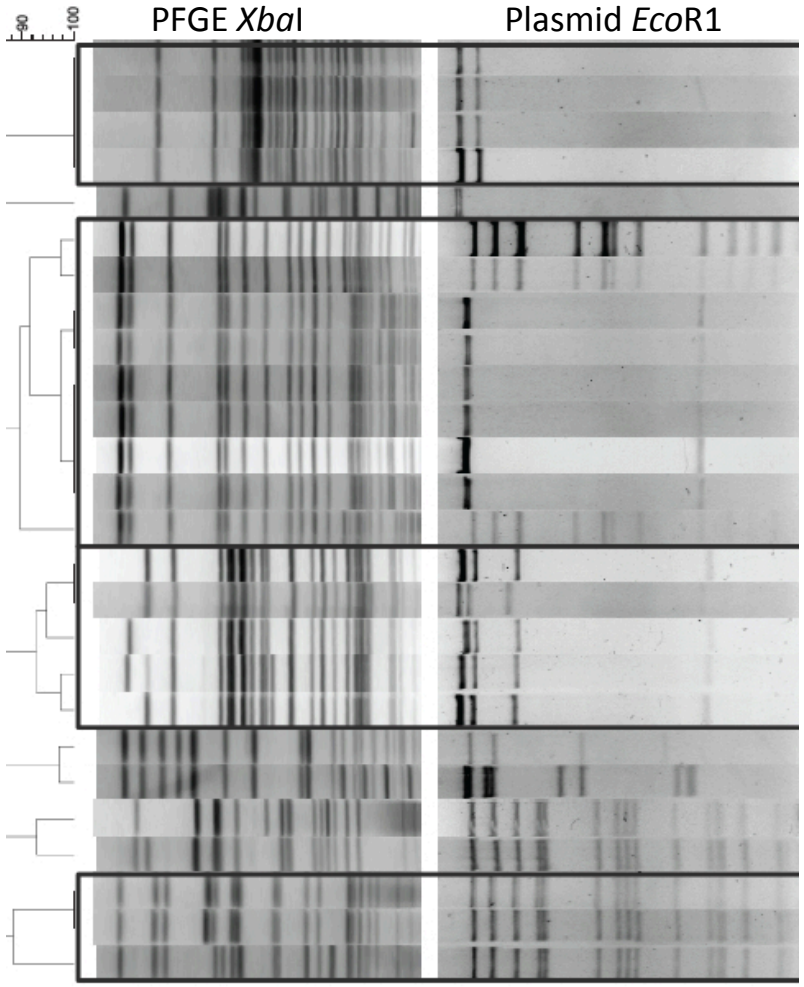
Single-molecule sequencing to track plasmid diversity of hospital-associated carbapenemase-producing Enterobacteriaceae

- Multiple CPO strains (*Klebsiella*, *Escherichia*, *Enterobacter*, *Citrobacter* and *Pantoea*)
- Carbapenemase is carried on multiple plasmids, including a novel promiscuous one
- Horizontal transfer of plasmids between strains was noted, mostly in the environment
- **Very complex network of plasmids with incredible diversity and range**

Conlan, S. et al. Sci Transl Med 6, 254ra126 (2014)

Polyclonal Outbreak of KPC-3-Producing *Enterobacter cloacae* at a Single Hospital in Montréal, Québec, Canada

Louis-Patrick Haraoui,[a] Simon Lévesque,[b] Brigitte Lefebvre,[b] Ruth Blanchette,[a] Melissa Tomkinson,[a] Laura Mataseje,[c] Michael R. Mulvey,[c] Mark A. Miller[a]

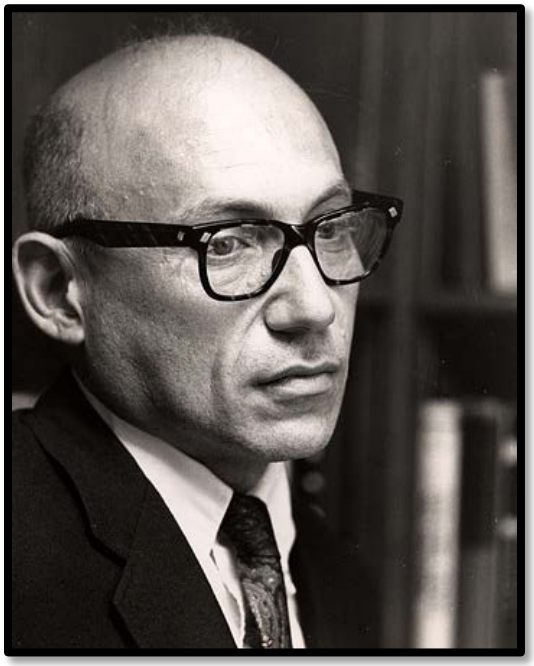


J Clin Microbiol 2013;51:2406-2408.

- 26 isolates of *E. cloacaea*
- 16 patients: 7 infected/9 colonized over 14 months
- ≥ 7 strains of *E. cloacaea*
- Multiple plasmids 28-103 kb
- Single Tn*4401* structure containing bla_{KPC}

Outbreak of a single gene or transposon

"The future of humanity and microbes will likely evolve as…episodes of **our wits vs. their genes"**

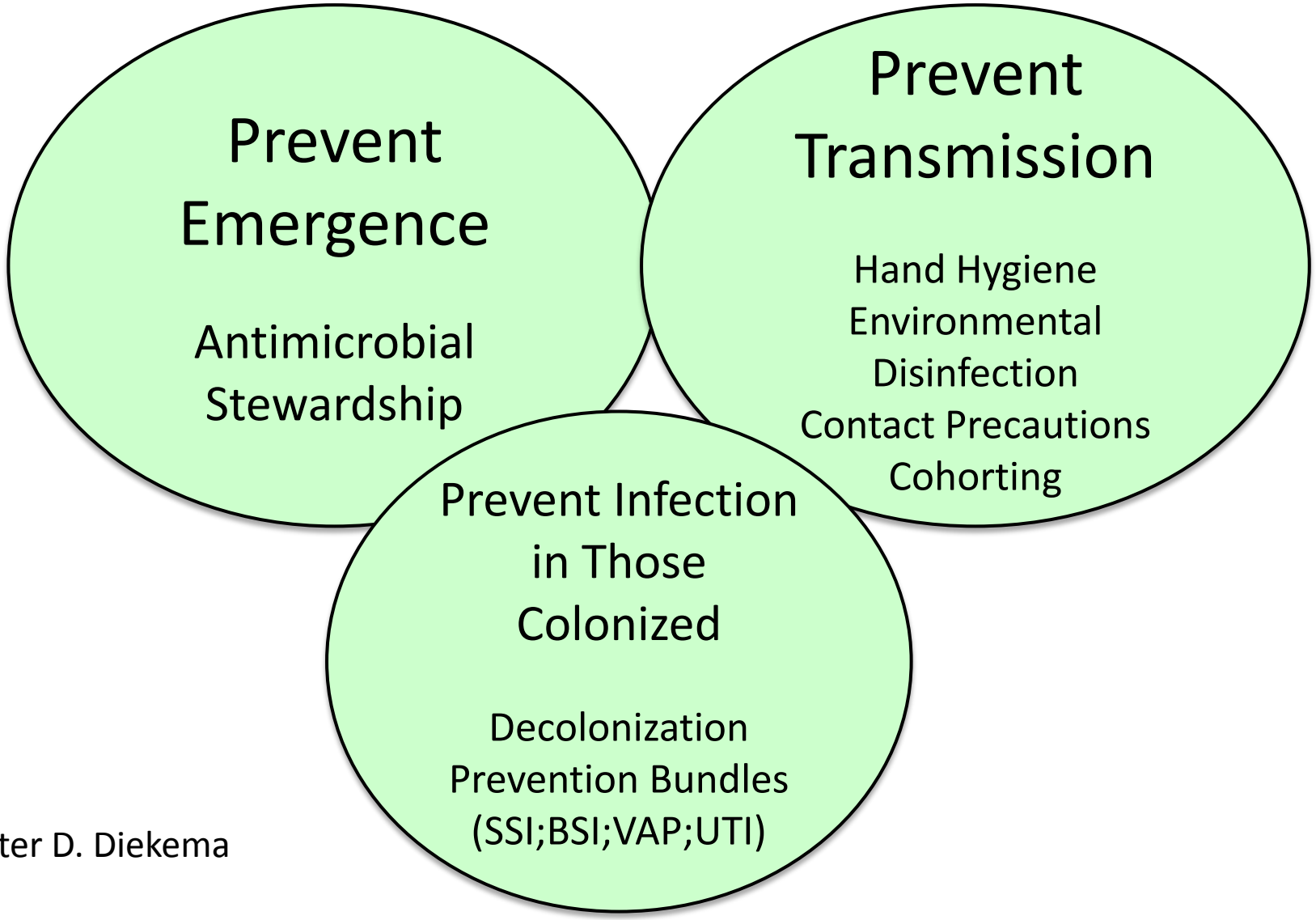


Dr. Joshua Lederberg

1953

We Can’t Win This War.

MDRO Mitigation Strategies

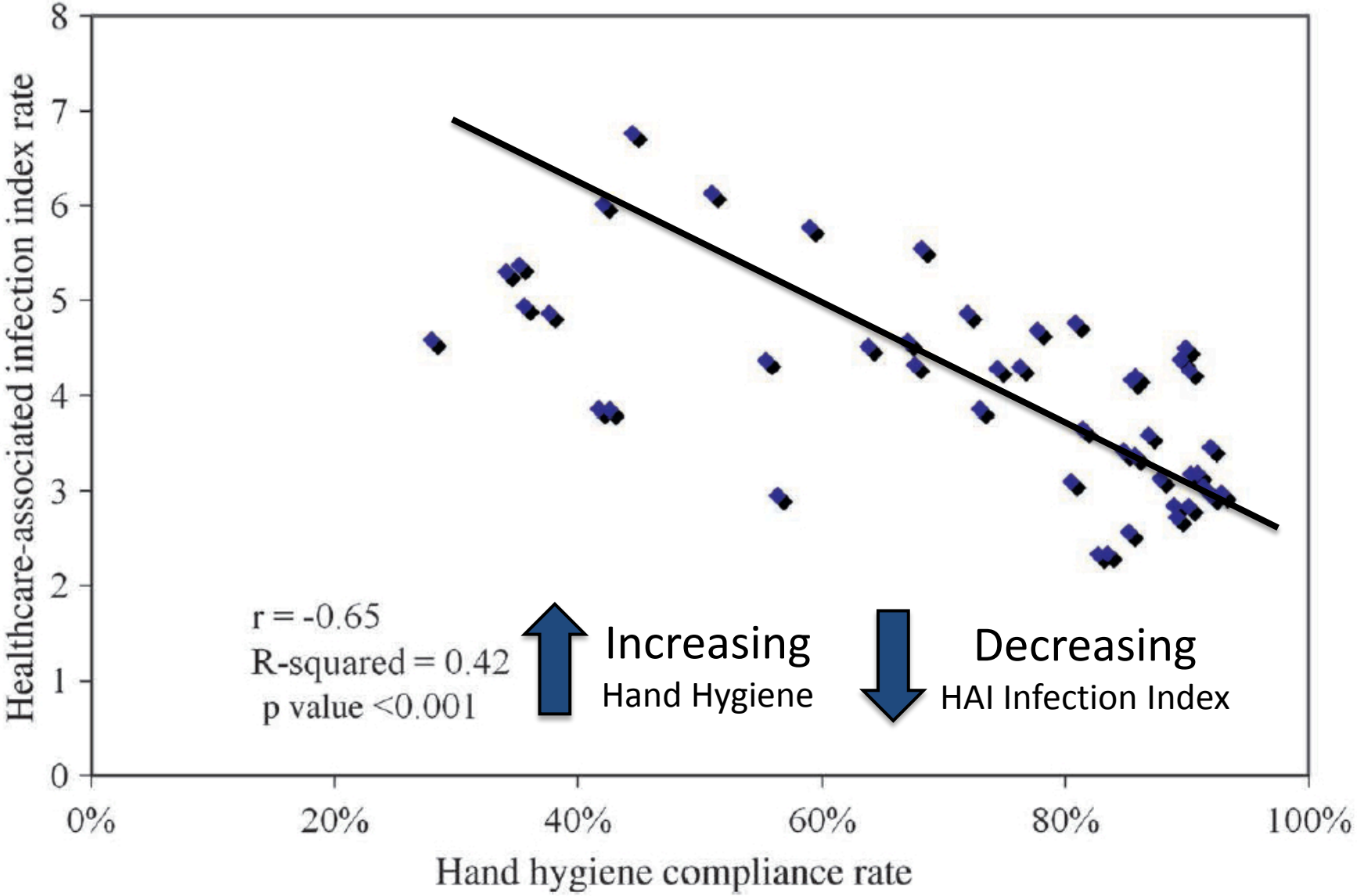


After D. Diekema

Summary of CRE Control Strategies

	PHAC (2010)	CDC (2012)	Australia (2013)	DHHS/AHRQ (2014)	UK Public Health 2013	ECDC (2011)
H.H.	+	+	+	+	+	+
Contact Precautions	+ ACF Single room/cohort	+ ACF + LTCF high risk	+ + risk-based in LTCF	+	+ preemptive Isolation	+ Preemptive Isolation
Staff Cohorting		When Possible				+
Promote Stewardship	+	+	+	+	+	+
Active Screening Surveillance +/- Point Prevalence	+ room-mates + Screen contacts	+ * + Screen High Risk Admissions & Transfers	+ transfers or hospitalized Overseas in last 12 months	+ point prevalence transfers and LTCF + escalate to all high risk, new admissions & transfers	Screen & Isolate if previous + or hospitalized overseas or high risk UK + contacts	+ any transfer across borders and any high risk patients
Other		CHG Baths		Change Management		Monitor Compliance

Hand Hygiene Reduces Infection



Kirkland, K. et al, BMJ Qual Saf 2012;21:1019-1026.

Pilot Testing of an Out-of-Country Medical Care Questionnaire with Screening and Cost Analysis of Preemptive Isolation for Carbapenem-Resistant Enterobacteriaceae in a Large Canadian Health Region

- 2 months screening in 4 Calgary Hospitals
- 13,835 admissions – questionnaire in 48%
- 206 (3.1%) had some out of country medical care
- 70 (0.5%) had inpatient hospitalization
- 101 patients screened for CRE – none positive
- Pre-emptive isolation = 400K for inpatient stays

Rajapaskse, N. Vayalumkal, J. Gregson, D., Louie, T., Conly, J. et al. ICHE;2014:35:450-51.

Effect of Daily Chlorhexidine Bathing on Hospital-Acquired Infection

Michael W. Climo, M.D., Deborah S. Yokoe, M.D., M.P.H., David K. Warren, M.D.,

Climo, M.W. et al. N Engl J Med. 2013;368:533-42.

Targeted versus Universal Decolonization to Prevent ICU Infection

Susan S. Huang, M.D., M.P.H., Edward Septimus, M.D., Ken Kleinman, Sc.D.,

Huang, S.S. et al. N Engl J Med 2013;368:2255-65.

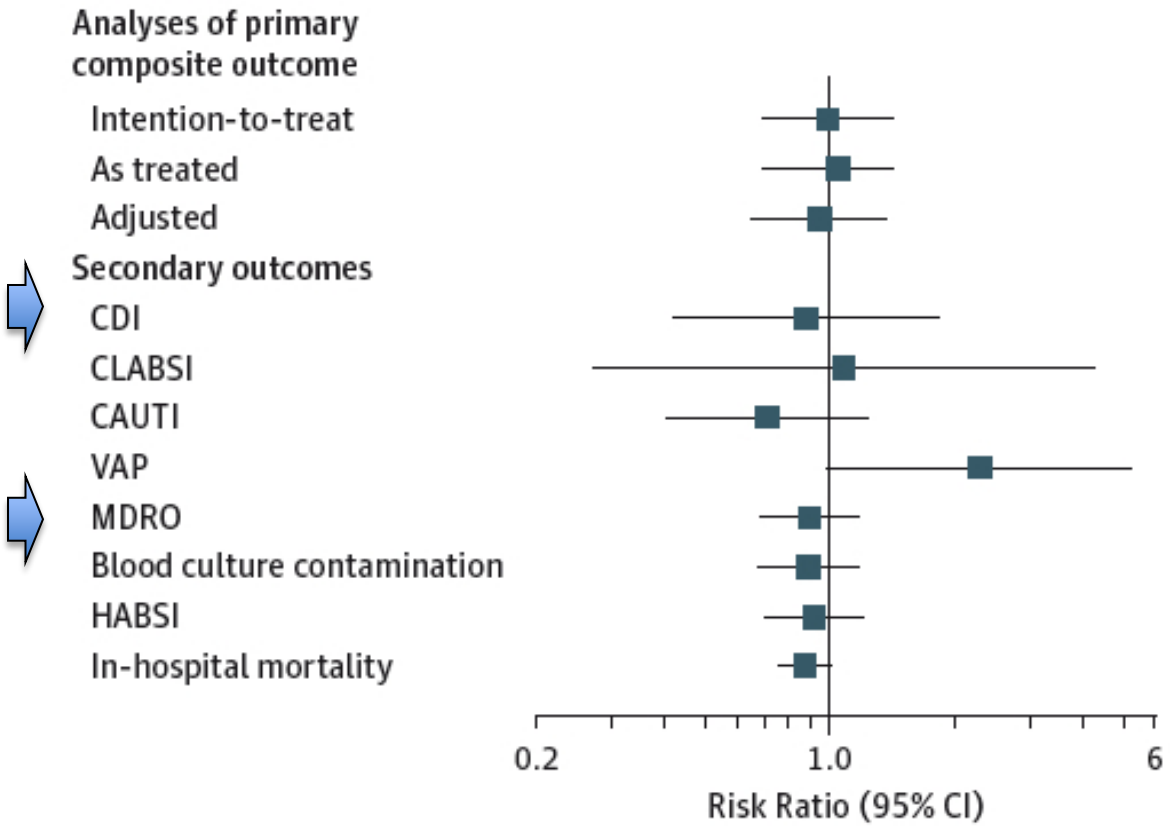
Daily chlorhexidine bathing to reduce bacteraemia in critically ill children: a multicentre, cluster-randomised, crossover trial

Milstone, A.M. et al. Lancet 2013;381:1099-106.

Original Investigation | CARING FOR THE CRITICALLY ILL PATIENT

Chlorhexidine Bathing and Health Care–Associated Infections
A Randomized Clinical Trial

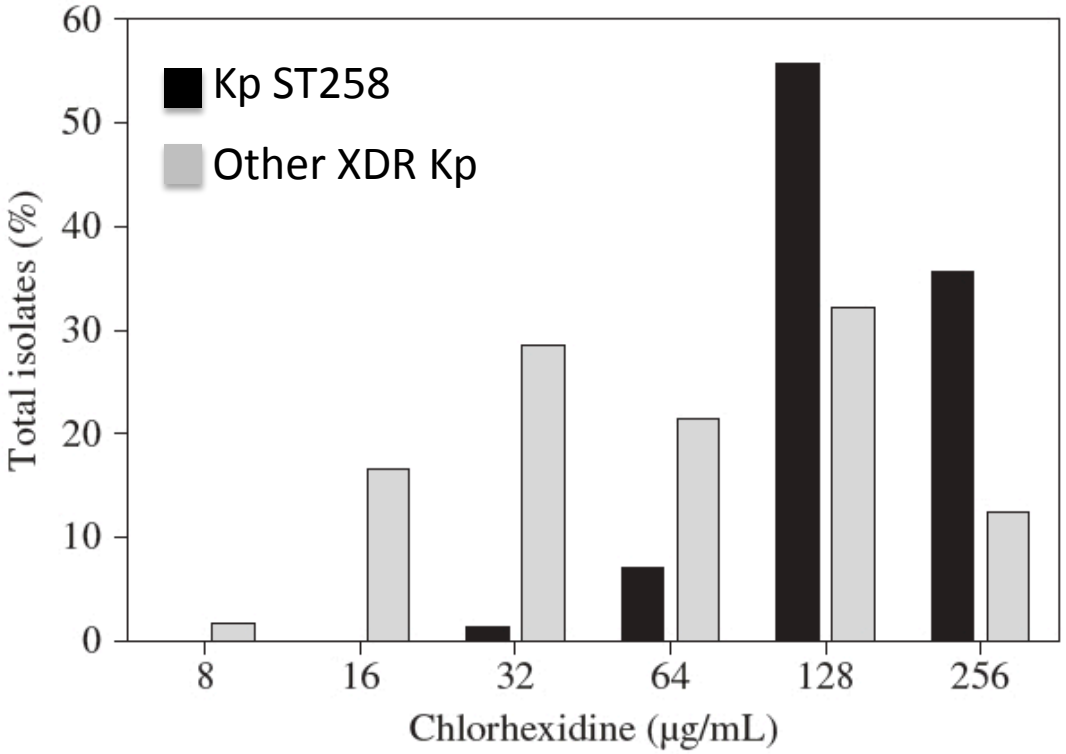
Michael J. Noto, MD, PhD; Henry J. Domenico, MS; Daniel W. Byrne, MS; Tom Talbot, MD, MPH; Todd W. Rice, MD, MSc; Gordon R. Bernard, MD; Arthur P. Wheeler, MD



Daily Bathing with CHG did not reduce HAI's including CDI and MDRO's

JAMA Online Jan. 20, 2015 doi:10.1001/jama.2014.18400

Reduced susceptibility to chlorhexidine among extremely-drug-resistant strains of *Klebsiella pneumoniae*



Reduced susceptibility to CHG may contribute to the success of *K. pneumoniae* as a nosocomial pathogen and may provide a selective advantage to the global epidemic strain Kp ST258

Naparstek, L. et al. J Hosp Infect. 2012;81:15-19.

Prevention of MDR – GNBs
Poor Evidence Base

- Reduce Emergence
  - Antimicrobial Stewardship
- Limit Transmission
  - Hand Hygiene
  - Contact Precautions
  - Environmental Disinfection
- Prevent Infection Among those Colonized
  - Horizontal Prevention Bundles

Vertical vs. Horizontal

Infection Control Reboot

Horizontal (Broad-based) Interventions

Hand Hygiene
Environmental Cleaning
Cleaning of Shared Equipment
(Universal Decolonization?)

Vertical (Organism-Specific) Interventions

Screening
Isolation
Targeted Decolonization

Marmuthu, K and Harbarth, S. Curr Opin Infect Dis 2014, 27:356–362

Objectives

- To describe existing and novel approaches to public health management of gonococcal infection
- To discuss advances in Infection Prevention and Control pertinent to management of *C difficile* and CPO's

Big 3

Epidemiology

&

Prevention

Thank-you

AMMI Canada – CACMID

Annual Conference • Conférence annuelle

Delta Prince Edward and Prince Edward Island Convention Centre

April 16 – 18 avril