Good Kindergarten Lessons Gone Bad: Stop Sharing Now!

Dr. Mark Joffe
University of Alberta
Alberta Health Services
Disclosures

• Advisory Boards
  – Abbvie; Merck; Paladin Labs

• Speaker’s Bureau
  – Merck;

• Clinical Trial Research Funding
  – Optimer; Cubist
Charlottetown tops best-to-visit list

The Canadian Press

TORONTO – Travel magazine Vacay.ca has ranked Charlottetown No. 1 on its list of the 20 best places to travel in Canada in 2014.

The P.E.I. capital is the focus of a yearlong, provincewide series of events, including exhibitions, festivals and theatre productions, marking the 150th anniversary of the 1864 Charlottetown Conference, which paved the way to Confederation three years later.

Part of the city’s downtown will be turned into a “celebration zone” where visitors will be able to follow the steps of the Fathers of Confederation.

Also on the Vacay.ca list are Winnipeg, where the Canadian Museum for Human Rights is slated to open in September, and Vancouver, which will stage the 30th anniversary of the TED conference in March.

Quebec City, another top destination, is presenting the 60th edition of the Quebec Winter Carnival from Jan. 31 to Feb. 16, and celebrating the 350th anniversary of the Basilica of Notre-Dame de Quebec throughout the year.
Charlottetown tops best-to-visit list
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
Drug-Resistant *Neisseria gonorrhoea*

This bacteria is an immediate public health threat that requires urgent and aggressive action.
Gonorrhea in Canada 1927-2012
Rate per 100,000 population

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

Chlamydia

Gonorrhea

1997
Gonorrhea in Canada 1991-2012
Rate per 100,000 in Men 20-24 and Women 15-19

Proportion of GC with Elevated MIC

CDC GISP Program

<table>
<thead>
<tr>
<th>Year</th>
<th>Cefixime</th>
<th>Azithromycin</th>
<th>Ceftriaxone</th>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<tr>
<td>2009</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>2010</td>
<td>1.4%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2012</td>
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<td></td>
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</table>

Cefixime: ≥0.25µg/mL
Azithromycin: ≥2.0µg/mL
Ceftriaxone: ≥0.125µg/mL

http://www.cdc.gov/std/stats12/gonorrhea.htm
**Neisseria gonorrhoeae Treatment Failure and Susceptibility to Cefixime in Toronto, Canada**


“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.

Cefixi-ME no longer Cefixi—YOU (or anyone else)
N. gonorrhoeae with Reduced Susceptibilities in Canada 2008-2013

Azithromycin
MIC ≥0.125mg/L
N~1000
Peak in 2010-2011

Cefixime
MIC ≥0.25mg/L
5%

Ceftriaxone
MIC ≥0.125mg/L
5%

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

WHO 2012 Action Plan

Global action plan
to control the spread and impact of
antimicrobial resistance in *Neisseria gonorrhoeae*

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
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
Partner (Contact) Tracing

Trace, Test and Treat

all contacts in the last 60 days
Re-screen All Individuals Diagnosed with GC after 6 mos
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
Whole Genome Sequencing to investigate strain relatedness, social networking and AMR

NG-MAST
*por* and *tbpB*
Sequence Typing

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

PHAC Webinar Antimicrobial Resistance – Gonococcal Infections October 2014
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

PHAC Webinar Antimicrobial Resistance – Gonococcal Infections October 2014
There’s an App for That!
There’s an App for That!

Controlling GC Resistance
Culture
Recommended Treatment
Test of Cure
Contact Tracing & Treatment
Would you like to come up with me, young sir—you will not be disappointed, come.
SHE MAY LOOK CLEAN - BUT

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

Her cold is just one thing you could catch.

Gonorrhea is on the rise.

sexgerms.com

“You’re full of moxie – also, gonorrhea.”
Clostridium difficile
U.S. CDC Antibiotic Resistance Threats, April 2013

250,000 Infections  14,000 Deaths  1 B Dollars
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

CDI Incidence per 10,000 patient-days

2009 2010 2011 2012 2013 2014*

Western: 4.12 5.51 4.56
Central: 6.00 7.00 6.00
Eastern: 2.52
Overall: 4.56

CNISP ARO Surveillance Report January 2015

*2014 data incomplete
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
- Shared Bathrooms
- Poor cleaning of shared equipment
- Lots of Broad-Spectrum Antibiotic Use
- Poor Hand Hygiene
- Poor Isolation Practices (Ignore Isolation Practices)
- Lots of Patient Movement
- PPI’s
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?

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 Fluroquinololones
Increased production of Toxins A & B

Production of Binary Toxin

Fluoroquinolone Resistance

Increased Sporulation

BI/Nap1/027

Increased Motility
Where Did it Come From?
Emergence and global spread of epidemic healthcare-associated *Clostridium difficile*

Miao He¹, Fabio Miyajima²,³, Paul Roberts²,³, Louise Ellison¹, Derek J Pickard¹, Melissa J Martin⁴, Thomas R Connor¹, Simon R Harris¹, Derek Fairley⁵, Kathleen B Bamford⁶,⁷, Stephanie D’Arc⁶,⁷, Jon Brazier⁸, Derek Brown⁹, John E Coia⁹, Gill Douce⁹, Dale Gerding¹⁰, Hee Jung Kim¹¹, Tse Hsien Koh¹², Haru Kato¹³, Mitsutoshi Senoh¹³, Tom Louie¹⁴, Stephen Michell¹⁵, Emma Butt¹⁵, Sharon J Peacock¹,¹⁶–¹⁸, Nick M Brown¹⁷,¹⁸, Tom Riley¹⁹, Glen Songer²⁰, Mark Wilcox²¹, Munir Pirmohamed²,³, Ed Kuijper²², Peter Hawkey²³, Brendan W Wren⁴, Gordon Dougan¹, Julian Parkhill¹ & Trevor D Lawley¹

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

Emergence and Global Spread of Epidemic HCA C. difficile

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

Sahil Khanna, MBBS¹, Darrell S. Pardi, MD, MS, FACG¹, Scott L. Aronson, MD¹,², Patricia P. Kammer, CCRP¹, Robert Orenstein, DO³, Jennifer L. St Sauver, PhD⁴, W. Scott Harmsen, MS⁵ and Alan R. Zinsmeister, PhD⁵

- 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 and J. Thomas Lamont, MD


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

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

Surbhi Leekha MBBS, MPH, Kimberly C. Aronhalt MA, RN, Lynne M. Sloan BS, Robin Patel MD, Robert Orenstein DO

320 Adults Admitted to Acute Care Hospital

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

<table>
<thead>
<tr>
<th>Variable</th>
<th>P value</th>
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<td>Recent Hospitalization</td>
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<td>Chronic Dialysis</td>
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<tr>
<td>Proton Pump Inhibitor Use</td>
<td>0.03</td>
</tr>
<tr>
<td>Corticosteroid Use</td>
<td>0.02</td>
</tr>
</tbody>
</table>

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

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

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.
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**

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.

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

Michelle J. Alfa PhD<sup>a,b,*</sup>, Evelyn Lo MD<sup>b,c</sup>, Nancy Olson BSc<sup>a</sup>, Michelle MacRae<sup>c</sup>, Louise Buelow-Smith RN<sup>c</sup>

- Reduction in CDI from 6 to 3/10,000pd required:
  - Dedicated trained Hskp
  - Monitoring & Feedback
  - Switch to Sporicidal Disinfectant Product (accelerated H<sub>2</sub>O<sub>2</sub>) for all high touch surfaces

Sequential Cleaning Interventions to Reduce CDI

No Touch Disinfection – UV Systems

- Sterilray
- The Torch
- Tru-D
- Surfacide
- Aseptix 2
- Xenex
- IRIS
- UVDI
No Touch Disinfection – $H_2O_2$ Systems

- Glosair (aHP)
- Nocospray (aHP)
- Bioquell*
  - $H_2O_2$ Vapour
- Steris $H_2O_2$ Vapour*
- AsepticSure*
  - 3% $H_2O_2$ / 50-500ppm Ozone
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.’
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.

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.

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, N. Desai, D. Aldred, T. Brown, I. Eltringham

28 interventions over 8 years in a large Teaching trust: 1. Strengthened IPC Accountability; 2. Improved Stewardship; and, 3. Improved Environmental Cleaning

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

O. Marufu\textsuperscript{a}, N. Desai\textsuperscript{a}, D. Aldred\textsuperscript{b}, T. Brown\textsuperscript{b}, I. Eltringham\textsuperscript{a,*}

“CRE HAVE BECOME RESISTANT TO ALL OR NEARLY ALL AVAILABLE ANTIBIOTICS”
Confusion in Terminology

J. Otter
THE LAST RESORT

THE RESISTANCE MOVEMENT
Carbapenem-resistant Enterobacteriaceae have been on the move since at least 1996.

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

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.”
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'

E. COLI CREEK

Fecal bacteria readings in Vancouver’s most contaminated body of water hit ‘unbelievable levels’  NEWS A3

Vancouver Province October 1, 2014
Two deaths at UCLA Medical Center have been linked to the case and seven others are being treated.

National KPC Outbreak in Israel

- National Guidelines - Central Coordination & Oversight
- Local Accountability - Daily Census Reporting
- Carriers Isolated/Cohorted & Physically Separate
- Dedicated Nursing Staff and Equipment

Late 2005 – import of Kp258
- Resistance
- Virulence
- Ease of Spread

Pre-Intervention (retrospective)

Post-Intervention (prospective)

Incidence of CRE by Clinical Culture per 100,000 patient-days

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


**Intervention** = Active Surveillance Cultures + Contact Isolation

52% of patients were detected by ASC

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17 mos  19 mos

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<th>Time, months</th>
<th>Cases per 10,000 patient-days</th>
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<td>24</td>
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## Israeli National Guidelines for CRE

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

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<th>Acute care hospitals</th>
<th>Post-acute care hospitals</th>
<th>Rehabilitation wards</th>
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<td>Skilled nursing/chronic ventilated/subacute wards</td>
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<td>Private or cohorting with other CRE carriers</td>
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<tr>
<td>Dedicated nursing staff for CRE</td>
<td>Required</td>
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<td>Required</td>
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<tr>
<td>carriers</td>
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<td>Use of gloves and gowns in care</td>
<td>Mandatory on room entrance</td>
<td>Mandatory on room entrance</td>
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<tr>
<td>of CRE carriers</td>
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<td>Regular mandatory census</td>
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<td>reporting to NCIC</td>
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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

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.

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

Overall (65)

Central

Western

Eastern

CNISP ARO Surveillance Report January 2015

CPO = Carbapenemase-producing organisms
‘Superbug’ stalked NIH hospital last year, killing six

By Brian Vastag
Wednesday, August 22, 2012
Possible Transmission Routes in NIH KPC Outbreak

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

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

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

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

- 26 isolates of E. cloacae
- 16 patients: 7 infected/9 colonized over 14 months
- ≥ 7 strains of E. cloacae
- Multiple plasmids 28-103 kb
- Single Tn4401 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 versus their genes”

Dr. Joshua Lederberg
1953
We Can’t Win This War.
MDRO Mitigation Strategies

Prevent Emergence
- Antimicrobial Stewardship

Prevent Transmission
- Hand Hygiene
- Environmental Disinfection
- Contact Precautions
- Cohorting

Prevent Infection in Those Colonized
- Decolonization
- Prevention Bundles (SSI; BSI; VAP; UTI)

After D. Diekema
## Summary of CRE Control Strategies

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<tbody>
<tr>
<td><strong>H.H.</strong></td>
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<tr>
<td><strong>Contact Precautions</strong></td>
<td>+ ACF Single room/cohort</td>
<td>+ ACF + LTCF high risk</td>
<td>+ risk-based in LTCF</td>
<td>+</td>
<td>+ preemptive Isolation</td>
<td>+ Preemptive Isolation</td>
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<tr>
<td><strong>Staff Cohorting</strong></td>
<td>When Possible</td>
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<tr>
<td><strong>Promote Stewardship</strong></td>
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<tr>
<td><strong>Active Screening Surveillance +/- Point Prevalence</strong></td>
<td>+ roommates + Screen contacts</td>
<td>+ * + Screen High Risk Admissions &amp; Transfers</td>
<td>+ transfers or hospitalized Overseas in last 12 months</td>
<td>+ point prevalence transfers and LTCF + escalate to all high risk, new admissions &amp; transfers</td>
<td>Screen &amp; Isolate if previous + or hospitalized overseas or high risk UK + contacts</td>
<td>+ any transfer across borders and any high risk patients</td>
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<tr>
<td><strong>Other</strong></td>
<td>CHG Baths</td>
<td></td>
<td></td>
<td>Change Management</td>
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<td>Monitor Compliance</td>
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Hand Hygiene Reduces Infection

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

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.,


Targeted versus Universal Decolonization to Prevent ICU Infection

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


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

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

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

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

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

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
Thank-you