Debate – Contact Precautions are Essential for the Management of Patients with MDROs
Prof. Eli Perencevich and Dr. Fidelma Fitzpatrick
Broadcast live from the Infection Prevention Society conference (www.ips.uk.net)

A Webber Training Teleclass
www.webbertraining.com

Conflicts of Interest Statement

- No financial conflicts
- Section Editor for Guidelines, Position Papers, and Invited Reviews @ ICHE
- Federal Funding
  - VA HSR&D (COIN and CREATE)
  - CDC Prevention Epicenter
  - AHRQ

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Contract Precautions Prevent Transmission

My Experience with Contact Precautions

Basics of How Contact Precautions Work

Review "Side Effects"

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Hand Hygiene Completely Dead

- "Hand Hygiene Compliance: are we kidding ourselves?"[1]
- Targets set at >90%, met by most facilities
- 2009-2014 Systematic Review[2]
  - Mean compliance before intervention **34%**
  - After intervention **57%**
- *If we can't do hand hygiene, we need SOMETHING to prevent transmission*

FOR MORE INFO...

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1. Mahida N. JHI 2016 (92) 307-8 2. Kingston L. et al. JHI 2016:309-20

Significant patient-to-patient spread occurring in ICUs

- Prospective cohort, 5 ICUs in 2 hospitals[1]
  - Genetically linked 10 pathogens
  - 14.5% of infections could be pt-to-pt
- Prospective cohort, German ICU[2]
  - PFGE for MRSA and PCR
  - **37.5% of nosocomial infections could be due to cross-transmission**

FOR MORE INFO...

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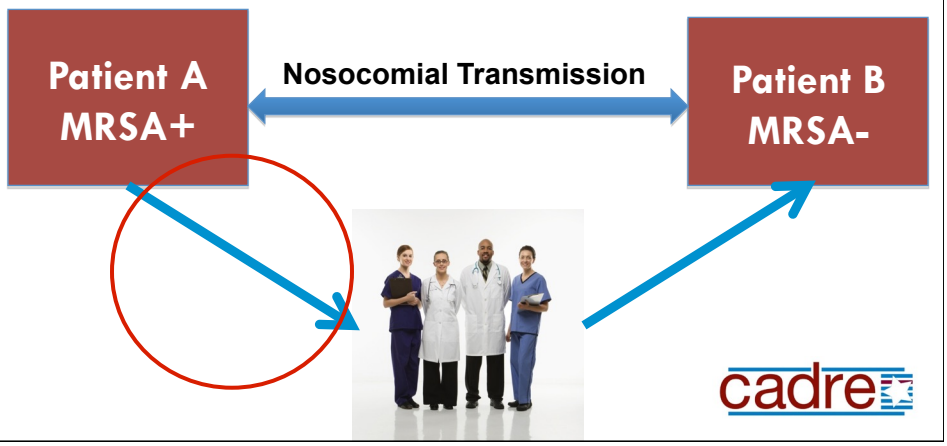
1.Grundmann H et al. Crit Care Med 2005 2. Weist K ICHE March 2002

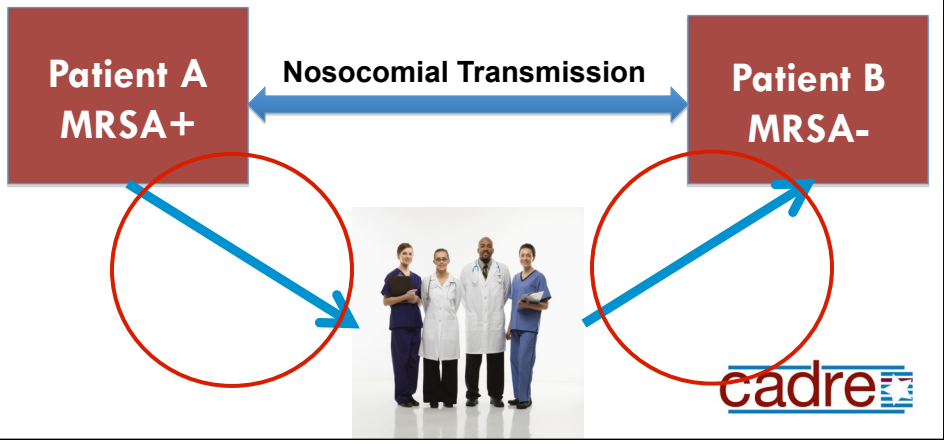
How CP are typically utilized

- Linked to active surveillance of MDRO patients
- Appears we are protecting HCW?



How might CP be better utilized?

- Strategies that isolate MDRO- patients protect them



Benefits of Active Surveillance (VRE)

Table 2. Estimated number of incident vancomycin-resistant enterococci (VRE) acquisitions and absolute number and proportion of cases prevented in 1 year with 3 competing infection-control strategies, after 1000 model simulations.

Infection control strategy	Average no. of incident VRE acquisitions	Estimated no. of incident cases of VRE colonization/infection prevented, compared with no surveillance strategy	Reduction of cases of VRE colonization/infection, compared with no surveillance strategy, %
No surveillance	118	…	…
Passive surveillance only	113	5	4.2
Active surveillance			
Patients isolated after culture results are determined to be positive	72.2	45.8	39
Immediate isolation and removal of patient after culture results are determined to be negative	41.1	76.9	65

NOTE. Each strategy is compared with a setting where no surveillance is in place.

FOR MORE INFO...

Perencevich et al. Clin Infect Dis 2003

Benefits of Isolation for VRE

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NOTE. Each strategy is compared with a setting where no surveillance is in place.

FOR MORE INFO...

Perencevich et al. Clin Infect Dis 2003

You can't study with Math Models

- The article by Perencevich et al. has potential for moving … infection-control communities closer to a tipping point on the control of this important pathogen… It has this potential because the model seems to be logical and mathematically correct (and) provides valuable insight into the importance of variables such as the prevalence of culture positivity at ICU admission and the duration of ICU stay." – Barry Farr, Clin Infect Dis 2003

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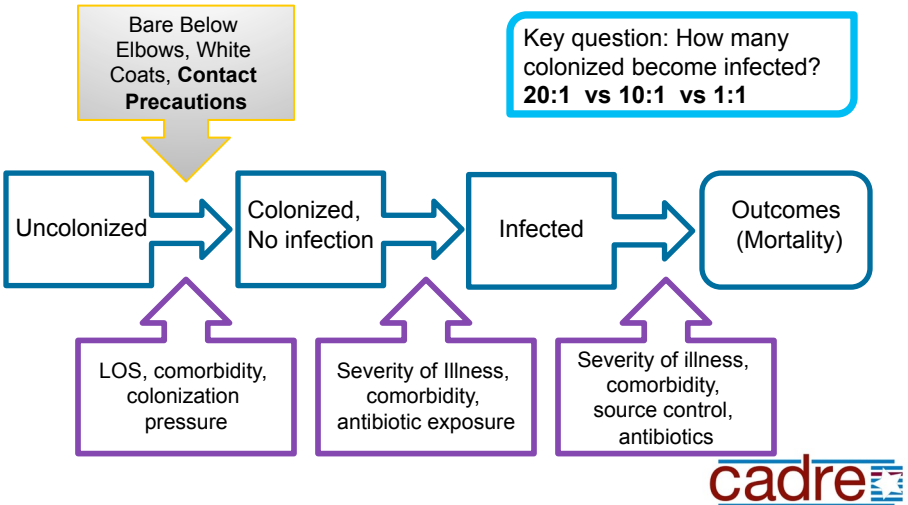
Interventions Targeting Transmission



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Studies don't include post-discharge infections

- Including 30-day post discharge incident MRSA infections tripled median incidence[1]
  - From 12.2 to 35.7/10,000 at risk admissions, p<0.01
  - Limited by use of ICD-9 code for MRSA
- Prospective cohort of 281 MRSA carriers[2]
  - 40% MRSA infections occurred during later hospitalizations, higher risk for recent carriers
- Prospective cohort of 209 new carriers[3]
  - 49% of incident MRSA infections were post-discharge

FOR MORE INFO...

1. Avery et al. ICHE February 2012 2. Datta R, Huang SS CID 2008
3. Huang SS, Platt R, Clin Infect Dis 2003

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Difficult to study contact precautions

- Need surveillance swabs on admission/ discharge to measure benefits
  - Sensitivity/specificity/costs of surveillance tests
  - Typically look at only 1-2 organisms
  - Very hard to power/design good efficacy trials
    - More likely to be underpowered/negative studies
- RCTs can't answer for all conditions
  - Organism prevalence, ICU length of stay
  - Need cohort studies and math models

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Don't wait for RCT

- Must consider other forms of epidemiological data when assessing benefits of contact precautions
- We will be waiting for years for well-powered RCTs
- Airline safety:
  - Tray tables up before take-off – RCT?
  - No sleeping in aisles of plane – RCT?
  - Parachutes

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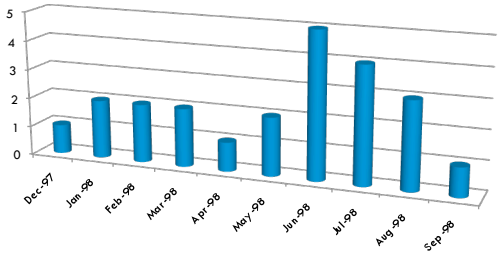
My Contact Precautions Decade

- July 2002, MICU
- Everyone on vacation, except…
- 5 patients with MDR-AB bacteremia in July
- 4 in August
- Control plan
- Shut MICU
- Press
- Ban artificial nails



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What happened?

- Lawsuits
- Closed MICU 2002
- Closed SICU 2007 and 2009
- Closed several Shock Trauma ICUs
- Universal gown/glove in MICU and SICU[1]
- Active surveillance on all transfers from OSH; isolated until cultures return
- Statewide AB surveillance (2010)

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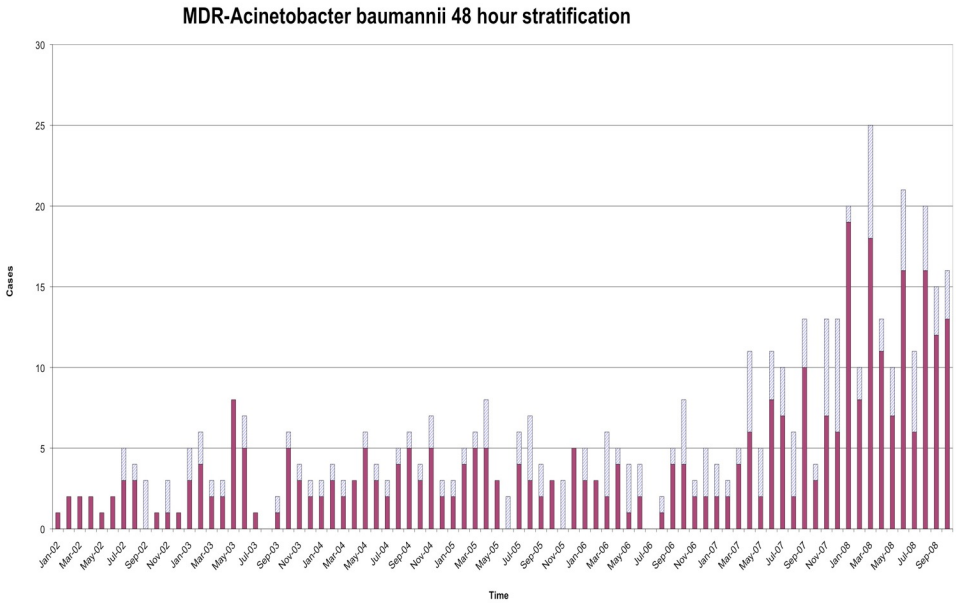
1. Wright MO et al, Infect Control Hosp Epi



Red >48 hours

Research Questions

- **1. How important are contact precautions for MRSA, VRE, MDR *A. baumannii or* MDR *P. aeruginosa*?**
- 2. How important is hand-hygiene after using contact precautions for MDR *A. baumannii*?

FOR MORE INFO...

1. Morgan D, et al, Infect Control Hosp Epidemiol July 2010
2. Snyder G, et al, Infect Control Hosp Epidemiol July 2008; 29(7):584-589

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Methods

- Cultured hands
  - before entry
  - gowns/gloves after exit
  - hands after gown/glove removal before hand hygiene

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Transmissibility and Protection

Organism	HCW Room Entries	Hand + Before (%)	Gown and/or Glove + After %	Hands + After Removal	Effectiveness of PPE
A. baumannii[1]	**202**	**1.5%**	**38.7%**	**4.5%**	**88%**
P. aeruginosa[1]	133	0%	8.2%	0.7%	90%
VRE[2]	94	0%	9%	0%	100%
MRSA[2]	81	2%	19%	2.6%	85%

FOR MORE INFO...

1. Morgan D, et al, Infect Control Hosp Epidemiol July 2010 (in press)
2. Snyder G, et al, Infect Control Hosp Epidemiol July 2008; 29(7):584-589

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Effectiveness of Gloves

- 50 HCW contacts with VRE+ patients
- 44 with Hands negative for VRE prior to contact
  - 6 were VRE+ before enrollment and excluded
- 17 of 44 HCW (39%) acquired VRE on their gloves
- 12 of these 17 (71%) HCW hands were VRE negative
- Thus, gloves reduce VRE transmission by **~70%**

FOR MORE INFO...

Tenorio et al. Clin Infect Dis, March 1, 2001:826-9

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More evidence for gloves

- Cultured patient, environment and 103 HCW hands/ gloves before and after 131 observations
- 52% contaminated on gowns/gloves after touching environment
- 70% contaminated after touching patient/environment
- Hands contaminated 37% of time if no gloves
- Only 5% hand contamination if gloves worn
- **86% benefit of gloves**

FOR MORE INFO...

Hayden M et al. ICHE 2008 Feb;29(2):149-54

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Transmission Matrix

How likely is a HCW to be contaminated after leaving room?

- Transmission data for MDR *A. baumannii*
- In relationship to compliance rates
- Assumption of independence of rates and 100% eradication with hand-hygiene

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A. baumannii: Transmission from Pt to HCW with Variable Compliance

Compliance with Hand-Hygiene							
0	36%	20%	17%	14%	11%	8%	5%
50%	18%	10%	9%	7%	5%	4%	2%
60%	15%	8%	7%	6%	4%	3%	2%
70%	11%	6%	5%	4%	3%	2%	1%
80%	7%	4%	3%	3%	2%	2%	1%
90%	4%	2.%	2%	1%	1%	1%.	1%
100%	0	0	0	0	0	0	0
	0	**50%**	**60%**	**70%**	**80%**	**90%**	**100%**

Compliance with Gloves (patients on contact precautions)

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Transmission from Patient to HCW with 50% hand hygiene compliance

Compliance with Hand-Hygiene							
0	36%	20%	17%	14%	11%	8%	5%
50%	18%	10%	9%	7%	5%	4%	2%
60%	15%	8%	7%	6%	4%	3%	2%
70%	11%	6%	5%	4%	3%	2%	1%
80%	7%	4%	3%	3%	2%	2%	1%
90%	4%	2.%	2%	1%	1%	1%.	1%
100%	0	0	0	0	0	0	0
	0	**50%**	**60%**	**70%**	**80%**	**90%**	**100%**

Compliance with Gloves (patients on contact precautions)

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What about 90% hand hygiene compliance?

Compliance with Hand-Hygiene	Compliance with Gloves (patients on contact precautions)						
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50%	18%	10%	9%	7%	5%	4%	2%
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70%	11%	6%	5%	4%	3%	2%	1%
80%	7%	4%	3%	3%	2%	2%	1%
90%	4%	2.%	2%	1%	1%	1%.	1%
100%	0	0	0	0	0	0	0
	0	**50%**	**60%**	**70%**	**80%**	**90%**	**100%**

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What about 90% hand hygiene and 70% CP compliance?

Compliance with Hand-Hygiene	Compliance with Gloves (patients on contact precautions)						
0	36%	20%	17%	14%	11%	8%	5%
50%	18%	10%	9%	7%	5%	4%	2%
60%	15%	8%	7%	6%	4%	3%	2%
70%	11%	6%	5%	4%	3%	2%	1%
80%	7%	4%	3%	3%	2%	2%	1%
90%	4%	2.%	2%	1%	1%	1%.	1%
100%	0	0	0	0	0	0	0
	0	**50%**	**60%**	**70%**	**80%**	**90%**	**100%**

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Contact Precautions Improve Hand Hygiene Compliance

- In long-term care, contact precautions associated with higher hand hygiene compliance[1]
  - Before interaction RR 1.76 (0.71-4.33)
  - **After interaction RR 2.68 (1.67-4.30)**
- 4 acute care hospitals with 7,743 HCW visits[2]
  - Entry compliance: 42.5% on CP vs 30.3%, p=0.14
  - **Exit compliance 63.2% on CP vs 47.4%, p<0.001**
- 38% hand hygiene **after** gloves vs 9.8% in ICUs[3]

FOR MORE INFO...

1. Thompson BL et al. ICHE 1997 2. Morgan DM et al ICHE 2013
3. Kim PW et al. AJIC 2003

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But what about this famous study?

INFECTION CONTROL AND HOSPITAL EPIDEMIOLOGY DECEMBER 2011, VOL. 32, NO. 12

ORIGINAL ARTICLE

"The Dirty Hand in the Latex Glove": A Study of Hand Hygiene Compliance When Gloves Are Worn

Christopher Fuller, MSc;[1] Joanne Savage, MSc;[1] Sarah Besser, MSc;[2] Andrew Hayward, MD;[1] Barry Cookson, FRCPath;[3] Ben Cooper, PhD;[4] Sheldon Stone, MD[5]

- 56 wards in 15 hospitals
  - England and Wales
  - International Press

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Minimal change AFTER contact

TABLE 2. Rates of Compliance with Hand Hygiene When Gloves Were Worn and When Gloves Were Not Worn

Type of moment	Proportion (%) of moments with hand hygiene compliance: When gloves were worn	When gloves were not worn	RR (95% CI)
All	415/1,002 (41.4)	1,344/2,686 (50.0)	0.83 (0.76–0.90)
By location			
Intensive therapy unit	246/514 (47.9)	488/896 (54.5)	0.88 (0.79–0.98)
ACE/GM ward	169/488 (34.6)	856/1,790 (47.8)	0.72 (0.64–0.83)
By risk level			
High-risk contact	213/484 (44.0)	72/123 (58.5)	0.75 (0.63–0.90)
Low-risk contact	203/518 (39.2)	1,272/2,563 (49.6)	0.79 (0.70–0.89)
By timing			
Before contact	98/330 (29.7)	170/424 (40.1)	0.74 (0.60–0.91)
After contact	317/672 (47.2)	1,174/2,262 (51.9)	0.91 (0.83–0.99)

NOTE. ACE/GM; acute care of the elderly and general medical; CI, confidence interval; RR, risk ratio.

FOR MORE INFO...

Fulmer C. et al. ICHE 2011

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FOR MORE INFO...

Fulmer C. et al. ICHE 2011

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AND no need to perform hand hygiene before donning gloves

- Prospective randomized trial of 230 HCW entering ICU rooms
  - Directly don nonsterile gloves
  - Perform hand hygiene and then don nonsterile gloves
- No significant difference in colony counts of gloved hands between groups, p=0.52
  - Ratio of mean colony counts 0.86 (0.53-1.37)

FOR MORE INFO...

Rock C. et al. AJIC, November 2013

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But do they work?

- Medical ICU implemented universal contact precautions during Maryland's Acinetobacter outbreak
- Quasi-experimental study, 6 months before/after
- Outcome: Acquisition of VRE and MRSA assessed with admission, weekly and discharge cultures
- **VRE acquisition declined, 21% to 9%, p=0.05**
- MRSA acquisition declined 14% to 10%, p=0.5

FOR MORE INFO...

Wright MO, et al. ICHE Feb 2004

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BUGG

Original Investigation

Universal Glove and Gown Use and Acquisition of Antibiotic-Resistant Bacteria in the ICU
A Randomized Trial

Anthony D. Harris, MD, MPH; Lisa Pineles, MA; Beverly Belton, RN, MSN; J. Kristie Johnson, PhD; Michelle Shardell, PhD; Mark Loeb, MD, MSc; Robin Newhouse, RN, PhD; Louise Dembry, MD, MS, MBA; Barbara Braun, PhD; Eli N. Perencevich, MD, MS; Kendall K. Hall, MD, MS; Daniel J. Morgan, MD, MS; and the Benefits of Universal Glove and Gown (BUGG) Investigators

- Match-paired cluster-RCT, 9 months
- 20 medical and surgical ICUs, 20 US Hospitals
- Powered to detect 25% reduction in VRE or MRSA
- **$5.7 million dollars**

FOR MORE INFO...

Harris AD, et al. JAMA 2013

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BUGG Intervention

- 26,180 patient admissions
- 92,241 swabs collected, over 84% compliance
- Intervention ICUs
  - Glove compliance 86%, gown 85%
- Control ICUs (10.5% on contact precautions)
  - Glove compliance 84%, gown 81%
- Comparing 85% patients under CP vs 8.5%

FOR MORE INFO...

Harris AD, et al. JAMA 2013

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MRSA and/or VRE

- MRSA and VRE -1.71 acquisitions per 1000 patient days (-6.15 to 2.73, p=0.57)
- VRE 0.89 acquisitions/1000 patient days, p=0.70
- **MRSA reduced -2.98 acquisitions/1000 patient days, (-5.58 to -0.38, p=0.046)**
- **40.2% reduction in MRSA in the intervention group vs 15% reduction in the control group**

FOR MORE INFO...

Harris AD, et al. JAMA 2013

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Other outcomes

- HCW visited one fewer time per hour
  - 4.28 vs 5.24, p=0.02
- Hand hygiene compliance on entry didn't differ
- Hand hygiene on exit improved with CP
  - 78.3% vs 62.9%, p=0.02
- No change in CLABSI, CAUTI, VAP or mortality rates

FOR MORE INFO...

Harris AD, et al. JAMA 2013

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Other infection related outcomes?

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FOR MORE INFO...

Harris AD, et al. JAMA 2013

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No difference in adverse events

- Random selection (N=90/ICU), chart review
- IHI Global trigger tool

Adverse events								
All	266	4585	58.7 (45.8 to 75.2)	369	4846	74.4 (57.9 to 95.6)	-15.7 (-40.7 to 9.2)	.24
Preventable	134	4585	29.0 (20.0 to 42.1)	156	4846	30.4 (21.7 to 42.7)	-1.4 (-19.4 to 16.6)	.88
Nonpreventable	132	4585	33.0 (24.3 to 45.0)	213	4846	43.3 (31.0 to 60.4)	-10.3 (-27.3 to 6.8)	.40
Severe	163	4585	36.5 (25.2 to 52.8)	245	4846	48.1 (35.7 to 64.6)	-11.6 (-32.4 to 9.2)	.31
Not severe	103	4585	23.6 (15.7 to 35.5)	124	4846	25.0 (18.9 to 33.2)	-1.4 (-13.1 to 10.3)	.82

FOR MORE INFO...

Harris AD, et al. JAMA 2013

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But what about the other bad side effects of contact precautions studies?

General Cohort		Congestive Heart Failure Cohort	
Precautions n=78	Controls n=156	Precautions n=72	Controls n=144

Outcomes:		
Length of Stay*	**31 vs. 12 days**	**8 vs. 6 days**
any Adverse Event*	**17% vs. 7%**	**47% vs. 25%**
Preventable AE*	**12% vs. 3%**	**29% vs. 4%**
Death	27% vs. 18%	21% vs. 15%

FOR MORE INFO...

Stelfox et al. JAMA October 2003

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But what about the other bad side effects of contact precautions studies?

General Cohort		Congestive Heart Failure Cohort	
Precautions n=78	Controls n=156	Precautions n=72	Controls n=144

Difference in Adverse Events due to:
—falls
— pressure ulcers
— fluid & electrolyte disorders

any Adverse Event*	**17% vs. 7%**	**47% vs. 25%**
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Precautions n=78	Controls n=156	Precautions n=72	Controls n=144

Study never adequately controlled for severity of illness

Preventable AE*	**12% vs. 3%**	**29% vs. 4%**
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FOR MORE INFO...

Stelfox et al. JAMA October 2003

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Contact Precautions associated with reduced healthcare worker visits

	Design	Effect
Kirkland & Weinstein 1999	Cohort	2.1 vs. 4.2 hourly contacts with HCWs
Saint et al 2003	Cohort	35% vs. 73% patients examined by attending physicians
Evans et al 2003	Matched cohort	5.3 vs. 10.9 contacts HCWs 22% less contact time overall
Morgan et al 2013	Cohort	2.78 vs. 4.37 visits/hour 17.7% less contact time 23.6% fewer visitors
Harris et al 2013	**Randomized controlled trial**	4.28 vs. 5.24 visits/hour

Are reduced visits "independently" bad?

- Independently = bad for patients without causing other problems
- If no adverse events in RCT then reduced visits could be good for patients (or at least not bad)
- **Fewer visits = fewer opportunities to transmit infections**
- **Fewer visits = fewer disruptions**
  - Detsky and Krumholz, reducing trauma of hospitalization (post-hospital syndrome)

FOR MORE INFO...

Detsky AS and Krumholz HM, JAMA June 2014

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Psychology of Isolation

	Setting	Design	Effect
Kennedy & Hamilton 1997	Spinal Cord rehab unit	16 cases/ 16 controls	85% believed CP limited rehab, More Anger 12.3 vs. 16.5 depression scores (NS)
Gammon 1998	Wards, 3 hospitals	20 cases/ 20 controls	30% higher depression and anxiety scores
Tarzi et al 2001	Rehab unit	20 cases/ 20 controls	33% vs. 77% depression 8.6 vs. 15 anxiety scores
Wassenberg et al. 2010	Tertiary Hospital	42 cases/ 84 controls	Small, nonsignificant difference in depression/anxiety at admission
Day et al. 2011	Veterans Hospital	20 cases/ 83 controls	Small, nonsignificant difference in depression/anxiety at admission
Day et al. 2011	Tertiary Hospital	Cohort of 28,564	40% more diagnoses of depression No difference in diagnosis of anxiety

Psychology of Isolation

	Setting	Design	Effect
Kennedy &	Spinal Cord	16 cases/	85% believed CP limited rehab, More

Cross-sectional studies. Studies have not controlled for baseline characteristics and underlying disease severity

Isolated patients are sicker independent of contact precautions exposure

al. 2010	Hospital	84 controls	depression/anxiety at admission
Day et al. 2011	Veterans Hospital	20 cases/ 83 controls	Small, nonsignificant difference in depression/anxiety at admission
Day et al. 2011	Tertiary Hospital	Cohort of 28,564	40% more diagnoses of depression No difference in diagnosis of anxiety

Patients on contact precautions are not more likely to develop depression or anxiety

- Prospective cohort of medical/surgical patients
  - Matched on hospital ward and month
- 148 exposed (contact precautions) vs 148 controls
- Enrolled on admission
  - 36-item questionnaire
  - Medical/Psychiatric history
  - Hospital Anxiety and Depression Scale (HADS)
  - Visual analog mood scales (VAMS)

FOR MORE INFO...

Day HR et al. ICHE March 2013

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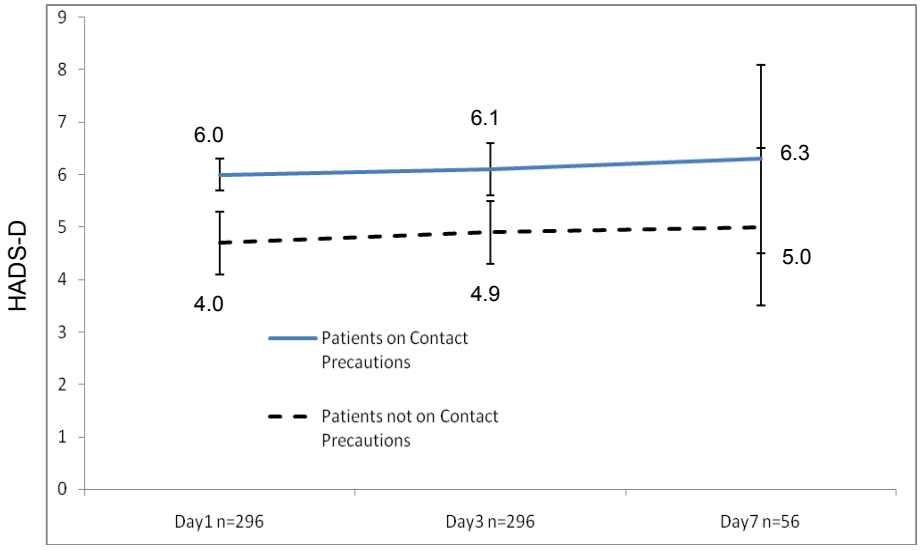
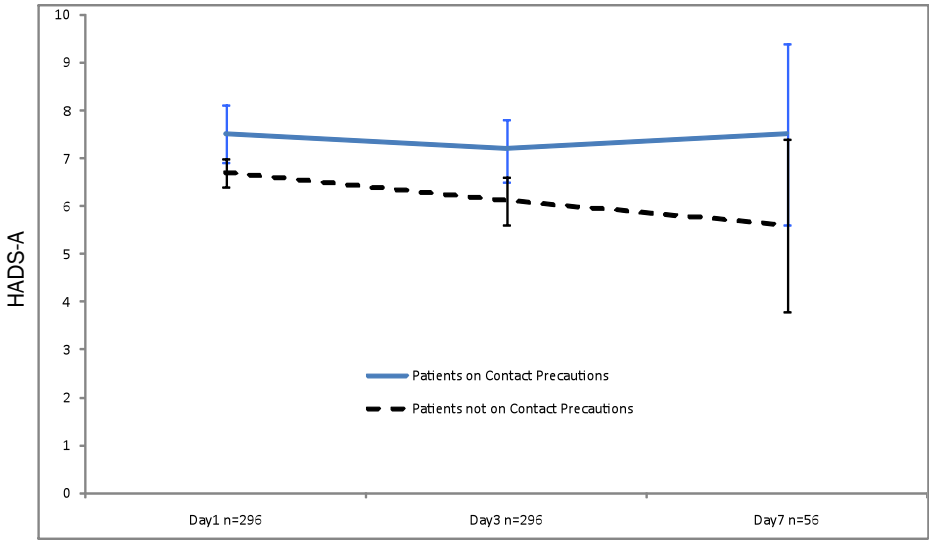
Stable Depression Symptoms with CP



Stable Anxiety Symptoms with CP



Contact Precautions Associated with Fewer Adverse Events

TABLE 3. Adjusted Rates of Noninfectious Adverse Events Among Patients on Contact Precautions vs Patients Not on Contact Precautions

Type of Adverse Event	R_tR (95% CI)	*P* Value
Noninfectious adverse events[a]		
Patients on contact precautions vs. not on contact precautions	0.70 (0.51–0.95)	.02
Prior hospitalization in previous 30 days	1.22 (0.87–1.70)	.25
Charlson comorbidity score ≥2	1.04 (0.75–1.45)	.80
Male gender	0.73 (0.54–0.99)	.05
Preventable noninfectious adverse events[a]		
Patients on contact precautions vs not on contact precautions	0.85 (0.59–1.24)	.41
Male gender	0.67 (0.46–0.98)	.04
Charlson comorbidity score ≥2	0.89 (0.60–1.33)	.57

FOR MORE INFO...

Croft LD etc., ICHE November 2015

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USE CONTACT PRECAUTIONS – NO FEAR

- Hand hygiene compliance remains poor
  - Contact Precautions 80-100% effective in reducing hand contamination
- Contact Precautions often bundled with active surveillance, but are effective alone
  - Data strongest for MRSA (also VRE, Acinetobacter)
- Side-effects greatly overblown
- Longer, less frequent HCW visits could be beneficial

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Acknowledgements

- Anthony Harris
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- Graeme Forrest
- Heather Reisinger
- Margaret Graham
- Michelle Shardell
- Lisa Pineles
- Kerri Thom
- Peter Kim
- Mary Claire Roghmann

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Thank you

cadre

Thank you – Questions?

- Hand hygiene compliance remains poor
  - Contact Precautions 80-100% effective in reducing hand contamination
- Contact Precautions often bundled with active surveillance, but are effective alone
  - Data strongest for MRSA (also VRE, Acinetobacter)
- Side-effects greatly overblown
- Longer, less frequent HCW visits could be beneficial

QUESTIONS? @eliowa eli-perencevich@uiowa.edu
stopinfections.org

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Debate – Contact Precautions are Essential for the Management of Patients with MDROs
Prof. Eli Perencevich and Dr. Fidelma Fitzpatrick
Broadcast live from the Infection Prevention Society conference (www.ips.uk.net)

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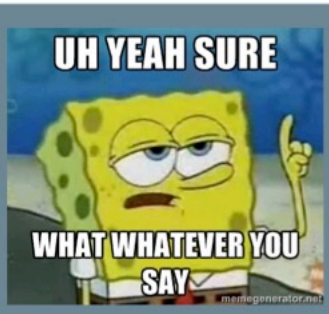
"This house believes that contact precautions are essential for the management of patients with MDROs"



Dr. Fidelma Fitzpatrick,
Senior Lecturer, Royal College of Surgeons in Ireland,
Consultant Microbiologist, Beaumont Hospital,
Dublin, Ireland
@ffitzP

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http://www.independent.ie/incoming/article34261654.ece/ALTERNATES/h342/6%20NEWS%20HN%20%20Little%20Red%20_5.jpg

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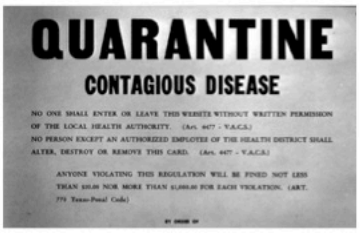
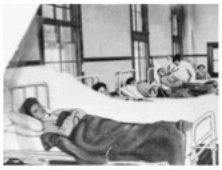


WHAT ARE CONTACT PRECAUTIONS?



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Standard Precautions *plus* something else

- Containment
  - Patients: Single room – cohort
  - Staff
- Dedicated equipment and supplies
- PPE
  - What?
    - Gloves
    - Apron
    - Long sleeved gown
    - Mask (???)
  - When to put on?
    - Before entering or red zone
  - Who?
    - Staff
    - Visitors?

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Approx 15% hospitalised patients under contact precautions at any one time

28.5% ICU / 19% ward MRSA/VRE alone

- J Hosp Infect 2011;79:103-7.
- N Engl J Med 2011;364:1419-30.
- Infect Dis Control Hosp Epidemiol 2016 Jul 26:1-9. - Epub

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HOW DO WE USUALLY DECIDE WHO GETS THEM?

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- Active screening
  - All
  - 'high risk' (whatever that is)
- Positive clinical cultures
- Previous MDRO
  - Forever
  - If not decolonised
- All of the above

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WHY DO WE DO IT?

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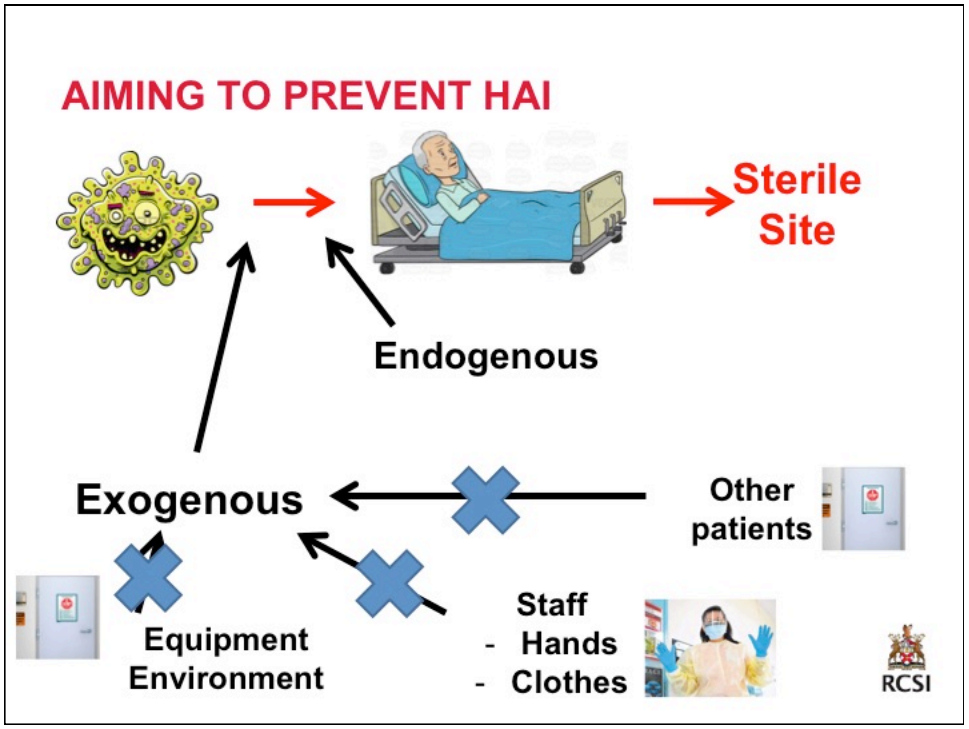

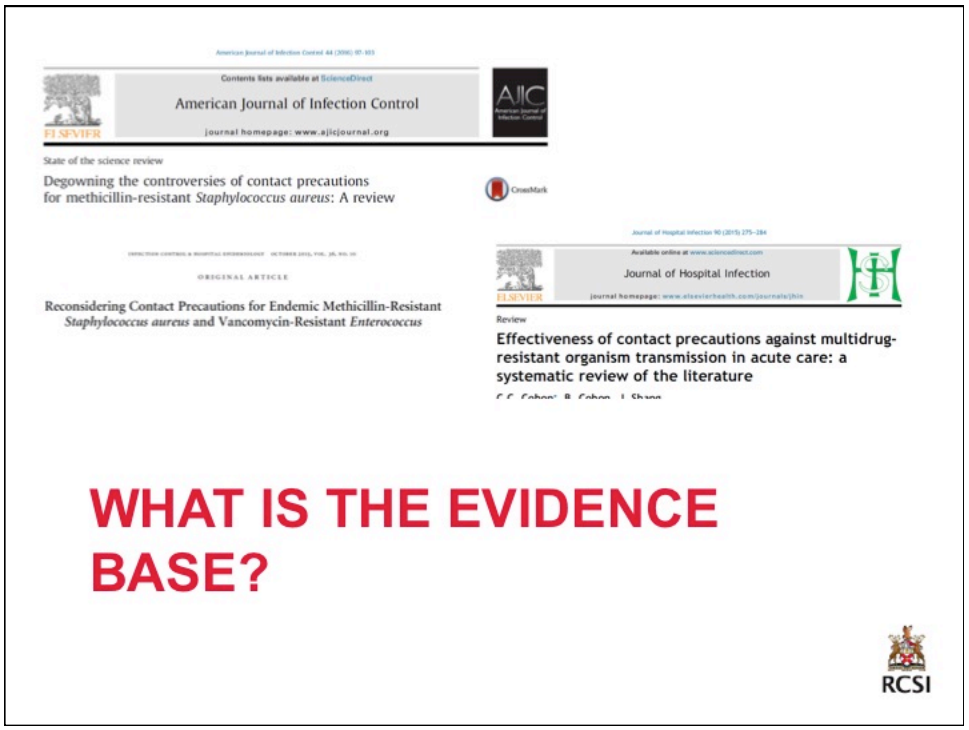

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OUTBREAKS

American Journal of Epidemiology
Copyright © 1996 by The Johns Hopkins University School of Hygiene and Public Health
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Vol. 143, No. 5
Printed in U.S.A.

Effectiveness of Contact Isolation during a Hospital Outbreak of Methicillin-resistant *Staphylococcus aureus*

John A. Jernigan,[1] Maureen G. Titus,[1] Dieter H. M. Gröschel,[1] Sandra I. Getchell-White,[1] and Barry M. Farr[1]

- July 1991-Jan 1992
- **Contact precautions (CP) vs. none in NICU**
- **Mask +** gown + gloves + isolation + staff screening
- Rate of MRSA transmission/d
- CP 0.009 vs. none 0.140
- **Discussion – older papers with failure of CP**

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Endemic MDRO

No study of Contact Precautions (**CP**) **vs. none!**

1. **ICU:**

Universal gown/glove vs. CP MRSA/VRE

- ***Decrease MRSA transmission (not VRE)***

2. **ICU + wards:**

CP - no CP (+ daily chlorhex + HH + bare below elbows)

- ***No change MRSA/VRE device infection***

3. **ICU + wards:**

MRSA bundle (included CP)

	ICU	Non ICU
MRSA transmission	Down 17%	Down 21%
HCA MRSA infection	Down 62%	Down 45%
HCA VRE infection	Down to zero	Down 73%

1. JAMA 2013;310:1571-80.
2. Infect Control Hosp Epidemiol 2015;39:978-80.
3. N Engl J Med 2011;364:1419-30.

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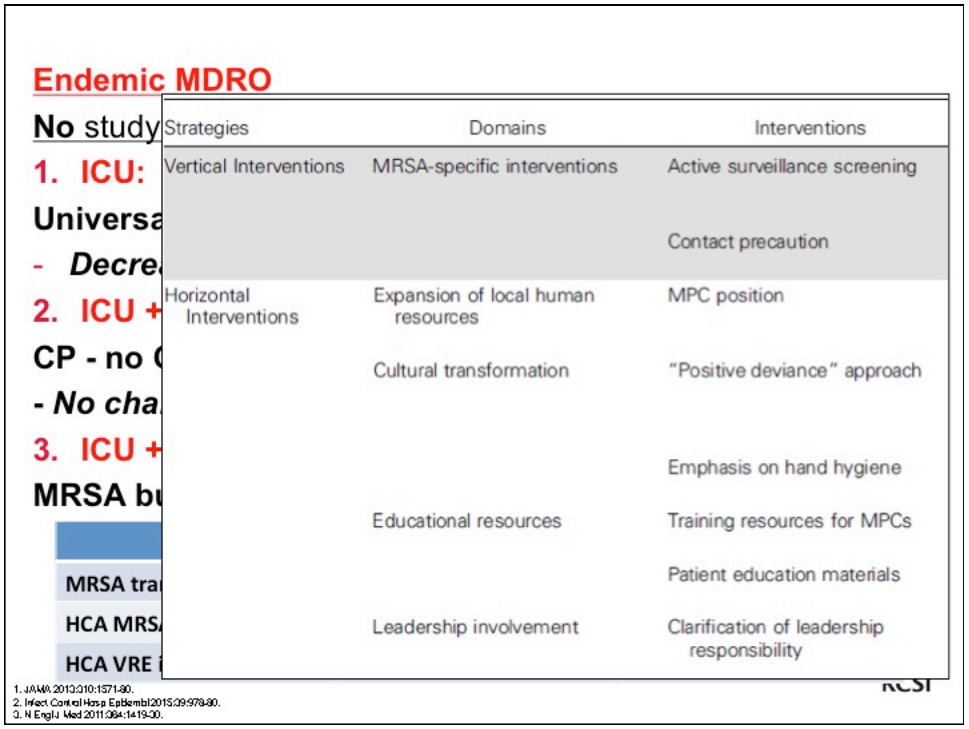

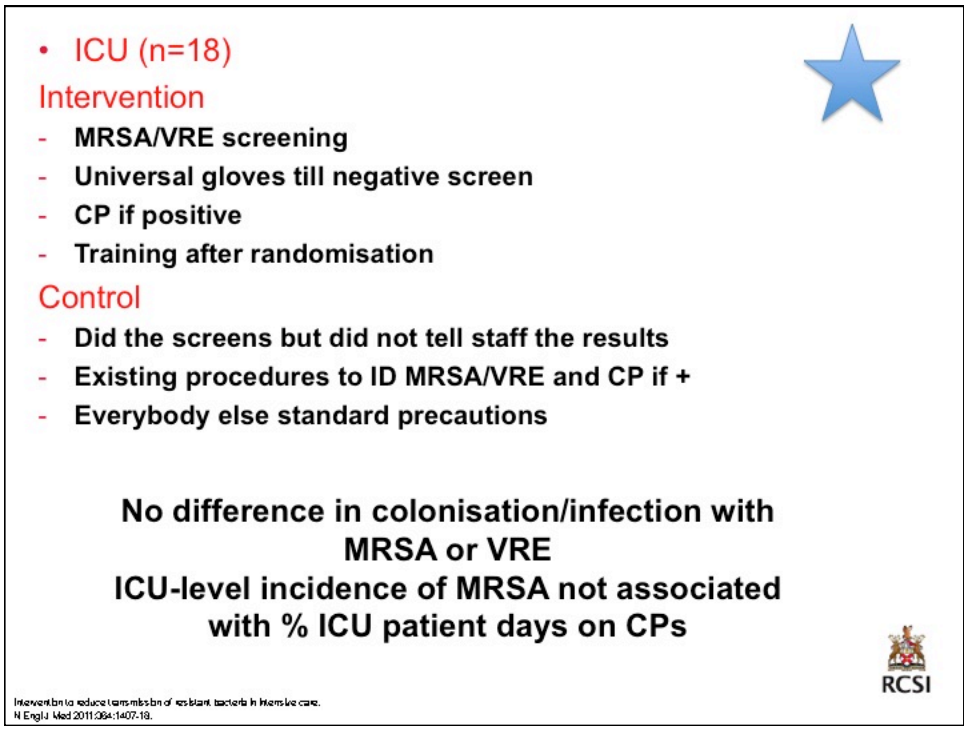

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Interventions to reduce colonisation and transmission of antimicrobial-resistant bacteria in intensive care units: an interrupted time series study and cluster randomised trial

13 EU ITUs

1. **Baseline**
2. **Universal CHG + Hand hygiene improvement**

Reduced acquisition of MDRO – principaly MRSA.

3. **Screening (conventional/rapid)+ contact precautions**

No incremental effect on acquisition.

Lancet ID 2014; 14:31-9

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INFECTION CONTROL & HOSPITAL EPIDEMIOLOGY OCTOBER 2015, VOL. 36, NO. 10

ORIGINAL ARTICLE

Reconsidering Contact Precautions for Endemic Methicillin-Resistant *Staphylococcus aureus* and Vancomycin-Resistant *Enterococcus*

Mainly ICUs

CP rarely analysed separately from other interventions

TABLE 1A. Literature Review of Articles From 2004 to 2013 That Examined the Effect of CP (With or Without Other Measures) on MRSA

			Interventions used						
Lead author	Trial design	Setting	Gowns	Gloves	Surveillance Culturing	HH	Universal decolonization	Targeted decolonization	Main findings
Trick et al[8]	RCT	SNFs	√	√	–	–	–	–	UG use was equivalent to CP in SNFs that did not limit patient activities
Lucet et al[14]	Before-after	ICUs	√	√	√	–	–	–	Surveillance cultures to guide CP led to a decrease in MRSA acquisition rates
Huang et al[15]	Quasi-experimental	ICUs	√	√	√	–	–	–	Surveillance cultures to guide CP decreased MRSA acquisition rates and BSI rates; some decrease in BSI rates observed hospital-wide
Robicsek et al[16]	Before-after	Hospital-wide	√	√	√	–	–	√	Surveillance cultures to guide CP and targeted colonization resulted in a decrease in invasive MRSA infection rates
Harbarth et al[9]	Cross-over quasi-experimental	Surgical patients	√	√	√	–	–	√	Surveillance cultures to guide CP and targeted decolonization did not reduce nosocomial MRSA infection rates with endemic MRSA prevalence
Bearman et al[34]	Before-after	ICUs	–	√	–	√	–	–	UG use was equivalent to CP for prevention of MRSA acquisition
Huskins et al[12]	RCT	ICUs	√	√	√	–	–	–	Surveillance cultures to guide CP vs standard CP alone resulted in equivalent MRSA acquisition or infection rates
Jain et al[17]	Before-after	Hospital-wide	√	√	√	√	–	–	Bundle of surveillance cultures to guide CP, HH, and institutional culture change was associated with a decrease in MRSA colonization and infection rates
Derde et al[68]	RCT	ICUs	√	√	√	√	√	√	No impact of surveillance cultures to guide CP
Harris et al[35]	RCT	ICUs	√	√	√	–	–	–	Universal CP use significantly reduced MRSA acquisition
Marshall et al[10]	Before-after	ICUs	√	√	√	–	–	–	Surveillance cultures to guide CP resulted in a decrease in MRSA acquisition rates

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ORIGINAL ARTICLE

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Mainly ICUs

CP rarely analysed separately from other interventions

TABLE 1B. Literature Review of Articles From 2004 to 2013 That Examined the Effect of CP (With or Without Other Measures) on VRE

			Interventions used						
Lead author	Trial design	Setting	Gowns	Gloves	Surveillance cultures	HH	Universal decolonization	Targeted decolonization	Main findings
Bearman et al[6]	Before-after	MICU	Before	√	√	√	No	No	No difference in VRE acquisition risk between CP and UG use
Bearman et al[34]	Before-after	SICU	Before	√	√	√	No	No	No difference in VRE acquisition risk between CP and UG use
Huskins et al[12]	RCT of 18 ICUs	ICU	√	√	√	√	No	No	No impact of surveillance culturing and isolation for MDROs
Harris et al[16]	RCT of 20 ICUs	ICUs	√	√	–	–	–	–	Universal CP use had no effect on VRE acquisition but was associated with less MRSA acquisition
Derde et al[11]	Before-after	ICU	√	√	√	√	√	No	No impact of surveillance culturing and isolation for MDROs

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OTHER FACTORS RARELY TAKEN INTO ACCOUNT

- Sensitivity of screening (including staff technique)
- Endogenous MDRO
- Patients not screened = reservoir
- Other sources of transmission
  - Staff
  - Environment
  - Equipment….not everything can be dedicated
  - Outside healthcare – Food / water / agriculture etc

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WHAT HAPPENS IF WE DON'T USE THEM?

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The Impact of Discontinuing Contact Precautions for VRE and MRSA on Device-Associated Infections

' In the setting of a strong horizontal infection prevention platform, discontinuation of contact precautions had no impact on device-associated hospital-acquired infection rates'

ICHE 2015 36(8) 978-980

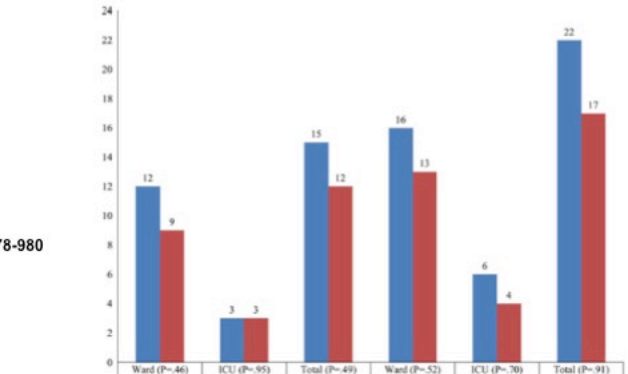

FIGURE 1. MRSA and VRE device-associated infections before and after discontinuation of contact precautions. Parentheses indicate rate per 1,000 device days. The Y-axis represents the number of device-associated infections.

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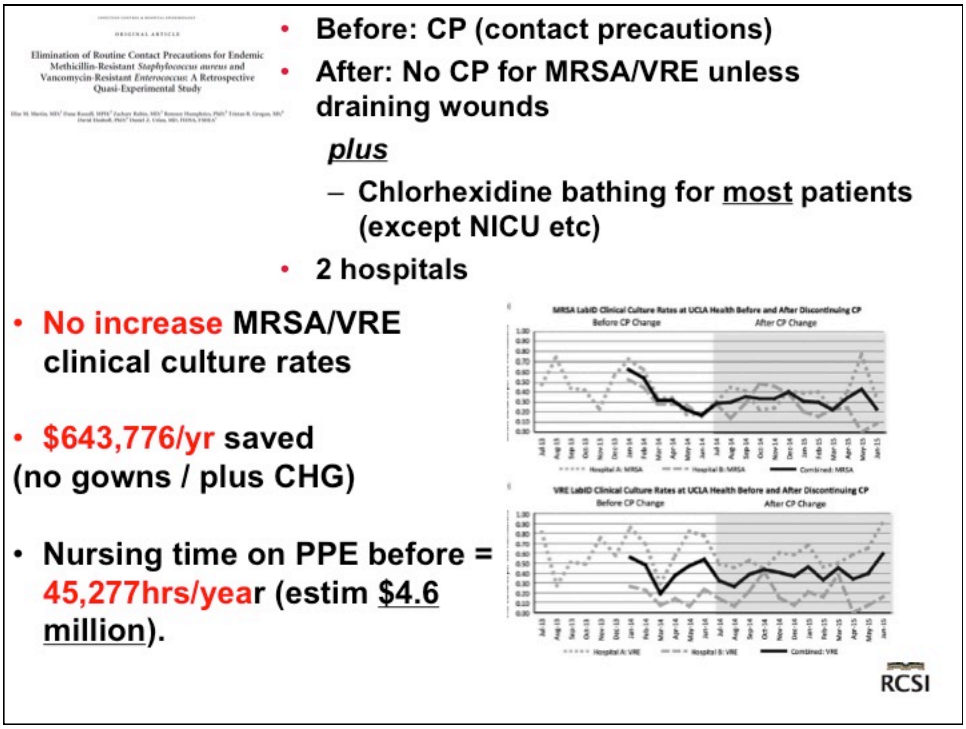

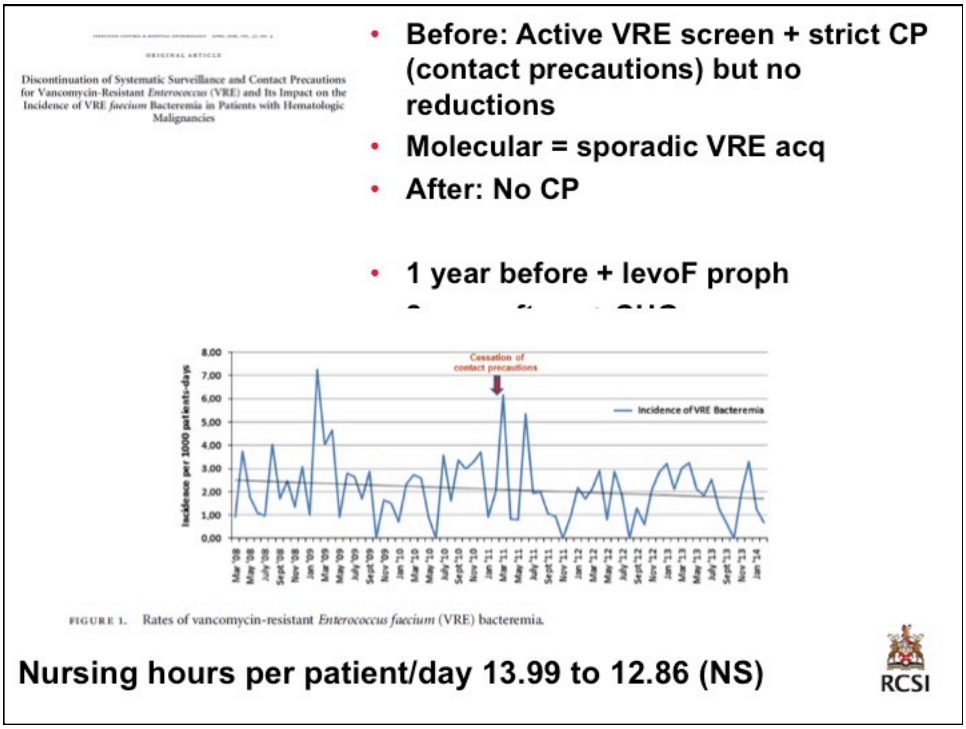

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Prospective Validation of Cessation of Contact Precautions for Extended-Spectrum β-Lactamase–Producing *Escherichia coli*[1]

- Transmission in 2/133 (1.5%) - Stopped CP
- 4.8% transmission
  - 4/151 – 2.6% (University Hospital)
  - 7/80 – 8.8% (Long term centre)
- Other Swiss studies
  - Hospitals: 2.8% transmission with contact precautions
  - Long term care: 6.5% transmission

1. CID 2012;55:1505-11
2. EID June 2016; 22(6); 1094-1097
3. CID 2012: 55:967-75
4. Swiss Med Weekly 2009:139:747-51
5. CMI 2012; 18 E497-505

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WHAT DO THE EXPERTS (US) DO AND BELIEVE?

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INFECTION CONTROL & HOSPITAL EPIDEMIOLOGY OCTOBER 2015, VOL. 36, NO. 10

ORIGINAL ARTICLE

Reconsidering Contact Precautions for Endemic Methicillin-Resistant *Staphylococcus aureus* and Vancomycin-Resistant *Enterococcus*

TABLE 3. Practices Being Used in Place of Standard Centers for Disease Control and Prevention Contact Precautions for Patients Identified With MRSA or VRE by a Convenience Sample of Hospitals in the United States

	Use of contact precautions				
Institution (number of hospitals)	MRSA	VRE	*C. difficile*	MDR-GNR	Year foregoing CP
Hospitals that practice enhanced focus on hand hygiene compliance and HAI prevention bundles (horizontal interventions)					
Virginia Commonwealth University MC	No	No	Yes	Yes	2013
University of Massachusetts (2 hospital campuses)	No	No	Yes	Yes	2010
Detroit MC (7 hospitals)	No	No	Yes	Yes	Prior to 2003
Tufts-New England MC	No	No	Yes	Yes	2010
St. Johns MC, Santa Monica, CA	No	No	Yes	Yes	2002
University of Rochester MC	No	No	Yes	Yes	2014
Baylor St. Luke's MC	No[a]	No	Yes	Yes	2005
UCLA (2 hospitals)	No	No	Yes	Yes	2013
University of Nebraska MC	No	No	Yes	Yes	2015
San Francisco General Hospital	No	No	Yes	Yes	Prior to 2002
University of San Francisco MC	No	No	Yes	Yes	Prior to 2002
Alta Bates MC, Oakland, CA	No	Yes	Yes	Yes	2014
University of Cincinnati MC	No	Yes	Yes	Yes	Prior to 2002
Oakwood Hospital System, MI (4 hospitals)	No	No	Yes	Yes	Prior to 2013
Hospitals that use gowns and gloves for syndromic indications only (diarrhea, draining wounds)					
Baystate Hospitals (multiple hospitals)	No	No	Yes	Yes	2003
Dartmouth MC[2]	No	No	Yes[b]	Yes	Prior to 2003
Hospitals that use decolonization of patients identified to have *S. aureus* (including MRSA)[c]					
Cleveland Clinic (10 hospitals)	No	No	Yes	Yes	Prior to 2003

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INFECTION CONTROL & HOSPITAL EPIDEMIOLOGY JANUARY 2016, VOL. 37, NO. 1

ORIGINAL ARTICLE

Routine Use of Contact Precautions for Methicillin-Resistant *Staphylococcus aureus* and Vancomycin-Resistant Enterococcus: Which Way Is the Pendulum Swinging?

- **Triggers for Contact Precautions**
  - clinical culture (97% MRSA,98% VRE)
  - active surveillance (87% MRSA,65% VRE),
  - preexisting HER alert (91%MRSA, 85% VRE),
  - suspicion of infection (36% MRSA,20% VRE)
- **Duration of isolation**
  - Indefinite (18% MRSA, 31% VRE),
  - Until negative (69% MRSA, 54% VRE),
  - 1 year after + (17% MRSA, 13% VRE),
  - Specific inpatient encounters (7% MRSA, 8% VRE)

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INFECTION CONTROL & HOSPITAL EPIDEMIOLOGY JANUARY 2006, VOL. 27, NO. 1

ORIGINAL ARTICLE

Routine Use of Contact Precautions for Methicillin-Resistant *Staphylococcus aureus* and Vancomycin-Resistant Enterococcus: Which Way Is the Pendulum Swinging?

- **Triggers for Contact Precautions**
  - clinical culture (97% MRSA,98% VRE)
  - active surveillance (87% MRSA,65% VRE),
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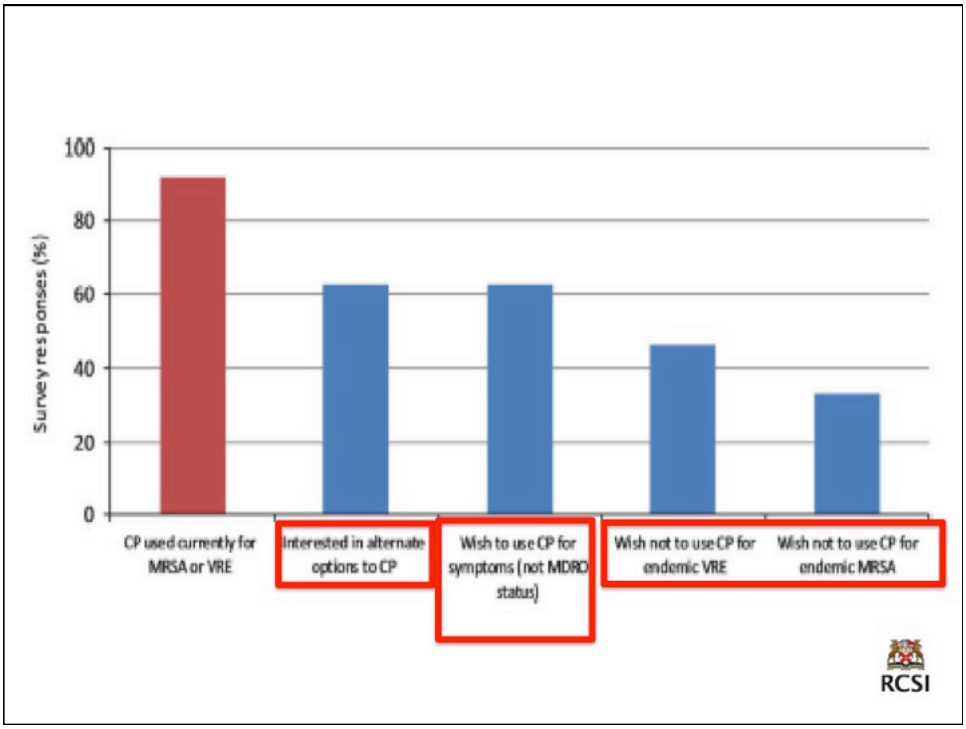

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ARE THERE ANY DOWNSIDES TO CONTACT PRECAUTIONS?

AJIC major articles

Adverse outcomes associated with contact precautions: A review of the literature

ORIGINAL ARTICLE

Effects of Contact Precautions on Patient Perception of Care and Satisfaction: A Prospective Cohort Study

Review Article

Patient Isolation Precautions: Are They Worth It?

- Contact isolation in surgical patients: a barrier to care? Surgery2003;134:180-8.
- The effect of contact precautions on healthcare worker activity in acute care hospitals. ICHE 2013;34:69-73.
- Do physicians spend less time with patients in contact isolation?: a time-motion study of internal medicine interns. JAMA Intern Med 2014;174:814-5.
- Safety of patients isolated for infection control. JAMA 2003;290:1899-905.
- Contact isolation for infection control in hospitalized patients: is patient satisfaction affected? ICHE 2008;29:275-8.
- Depression, anxiety, and moods of hospitalized patients under contact precautions. ICHE 2013;34:251-8.
- Anxiety and depression in hospitalized patients in resistant organism isolation. Southampt Med J 2003;96:141-5.

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Taking Off the Gloves: Toward a Less Dogmatic Approach to the Use of Contact Isolation

Kathryn B. Kirkland

- **Public health intervention to interrupt transmission**
- **Intended benefits not for the isolated patient but for other patients who may be at risk of acquiring infection if isolation is not imposed.**
- **Infringes on the personal rights of the individual in the name of protection of the public health**

Clinical Infectious Diseases 2009; 48:766–71

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PROBLEMS WITH CONTACT PRECAUTIONS?

- **Patient:**
  - Restricts free movement
  - Psychological
    - Loneliness – 23% fewer visitors
    - Stigma /depression (?) / anxiety (?)
    - X2 likely to perceive issues with their care
  - Receives different levels of care from staff????
    - Reduced frequency of staff visits (36-50% less)
    - Less contact time (17-22% less)
    - Less likely to have vital signs recorded (51 vs 31%)
    - More likely to have no MD note (26 vs 13%)
    - More adverse events??
  - Delays in discharge
  - Patient satisfaction? More likely to complain
- **Other Patients:**
  - Admission delays

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DELAYS

Delays in accessing radiology in patients under contact precautions because of colonization with vancomycin-resistant enterococci

- **Median time for CT**
  9.8 hrs vs. 18.9 hrs (Contact Precautions)


Journal of Hospital Infection

Impact of admission screening for meticillin-resistant *Staphylococcus aureus* on the length of stay in an emergency department

MRSA status = predicted a longer ED stay

Am J Infect Control 2013; 41: 1141-1142.

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Original Investigation

Universal Glove and Gown Use and Acquisition of Antibiotic-Resistant Bacteria in the ICU
A Randomized Trial

Anthony D. Harris, MD, MPH; Lisa Pineles, MA; Beverly Belton, RN, MSN; J. Kristie Johnson, PhD; Michelle Shardell, PhD; Mark Loeb, MD, MSc; Robin Newhouse, RN, PhD; Louise Dembry, MD, MS, MBA; Barbara Braun, PhD; Eli N. Perencevich, MD, MS; Kendall K. Hall, MD, MS; Daniel J. Morgan, MD, MS; and the Benefits of Universal Glove and Gown (BUGG) Investigators

- **Universal gown and gloves Vs CP if MRSA/VRE +**
- Fewer staff visits
- No difference in adverse events
- Better hand hygiene on exit

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Journal of Hospital Infection

Impact of contact precautions on falls, pressure ulcers and transmission of MRSA and VRE in hospitalized patients

- **No contact precautions for MRSA/VRE patients**
- **No significant differences before and after**
  - **Falls and pressure ulcers among MRSA/VRE patients**
  - **MRSA or VRE hospital-acquired transmission.**

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COSTS

- Mean cost associated with MRSA/VRE isolation $400–$2000 per positive-patient per day

- PPE / isolation room
- Screening: + *follow up* + *repeat testing* -laboratory / ward/ IPCT
- Hidden costs - time: Patient flow / IPCT managing isolation rather than more strategic issues / ward
- Unfactored costs: delayed discharge / postponed surgeries.
  - patients on CPs stay longer while awaiting transfer: mean 10.9 vs. 4.3 days
- Who pays??

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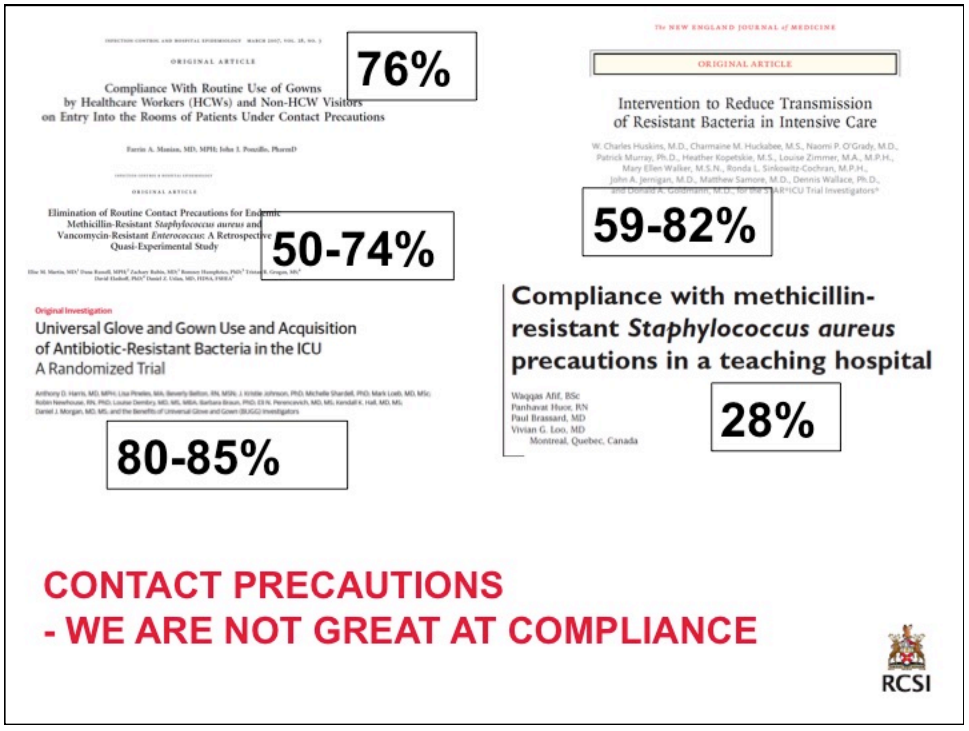

ETHICAL PRINCIPLES TO CONSIDER?

- Do we have justifiable goals and evidence for the effectiveness of contact precautions?
- Benefits vs. Harm
- Have we considered less harmful alternatives

Clinical Infectious Diseases 2009; 48:766–71

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ISSUES OF FAIRNESS

- Why not use universally rather than variably to subsets of patients that you have just happened to ID as MDRO?
- Only isolating a subset of colonised patients =
  - unfairly subjects some patients to the risk of potential harm associated with contact precautions
  - unfairly deprives others from the transmission of MDRO
- Screening for select bugs will miss others that can equally be as pathogenic (e.g., MSSA)

Clinical Infectious Diseases 2009; 48:766–71

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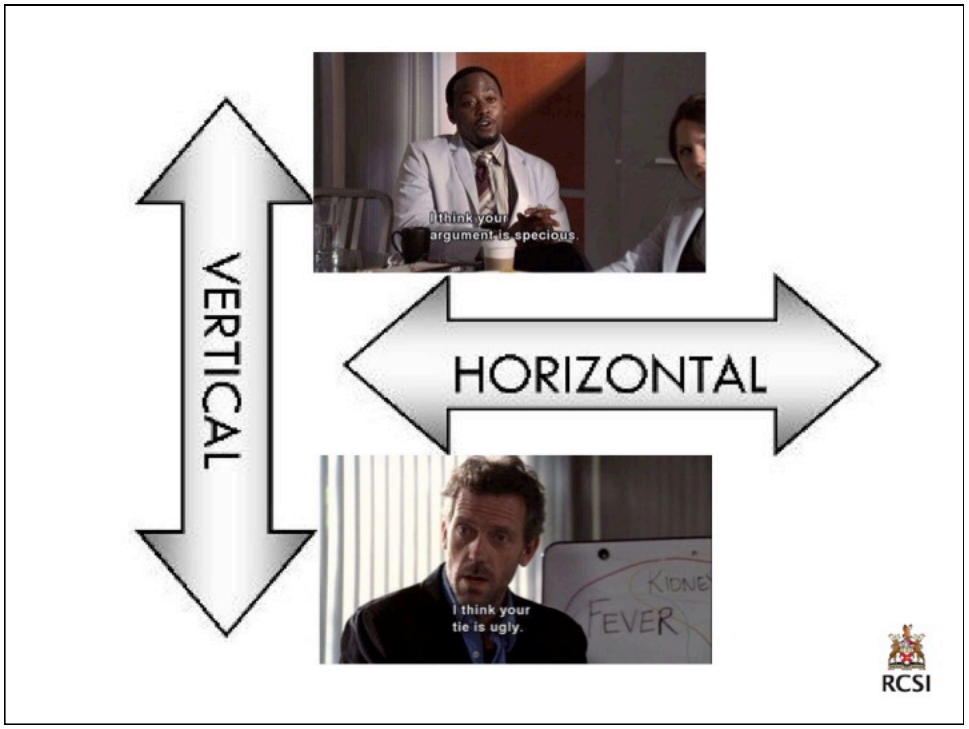

Vertical / Bug specific	Horizontal
Target specific pathogens	
Active surveillance Followed by measures to prevent transmission from colonised/infected patients to others. - contact precautions, - decolonisation	
Narrow – specific pathogen	
High resource utilization	
? promotes exceptionalism (some organisms are more important that others)	
Short term	

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Septimus E. MD, Weinstein RA, Perl TM, Gottmann DM and Yokoe DS. Commentary: Approaches for Preventing Healthcare-Associated Infections: Go Long or Go Wide? Infection Control and Hospital Epidemiol Vol 35, No. 7, July 2014.

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Vertical / Bug specific	Horizontal
Target specific pathogens	Many pathogens
Active surveillance Followed by measures to prevent transmission from colonised/infected patients to others. - contact precautions, - decolonisation	• Antimicrobial stewardship • Standard precautions – hand hygiene / environmental cleaning • Device Infection Prevention • Universal decolonization -Chlorhexidine bathing / SDD • Universal use of gloves or gloves and gowns
Narrow – specific pathogen	Broad – all pathogens
High resource utilization	Lower resource utilization
? promotes exceptionalism (some organisms are more important that others)	utilitarian
Short term	Longer term

Septimus E, MD, Weinstein RA, PerlTM, Gaitmann DA and Yokoe DS. Commentary: Approaches for Preventing Healthcare-Associated Infections: Go Long or Go Wide? Infection Control and Hospital Epidemiol. Vol 35, No. 7, July 2014.

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THE KNOCK ON EFFECTS OF MRSA PREVENTION….WITH HORIZONTAL MEASURES?

Strategies	Domains	Interventions
Vertical Interventions	MRSA-specific interventions	Active surveillance screening
		Contact precaution
Horizontal Interventions	Expansion of local human resources	MPC position
	Cultural transformation	"Positive deviance" approach
		Emphasis on hand hygiene
	Educational resources	Training resources for MPCs
		Patient education materials
	Leadership involvement	Clarification of leadership responsibility

The Effect of a Nationwide Infection Control Program Expansion on Hospital-Onset Gram-Negative Rod Bacteremia in 130 Veterans Health Administration Medical Centers: An Interrupted Time-Series Analysis Clinical Infectious Diseases 2016 63: 642-650.

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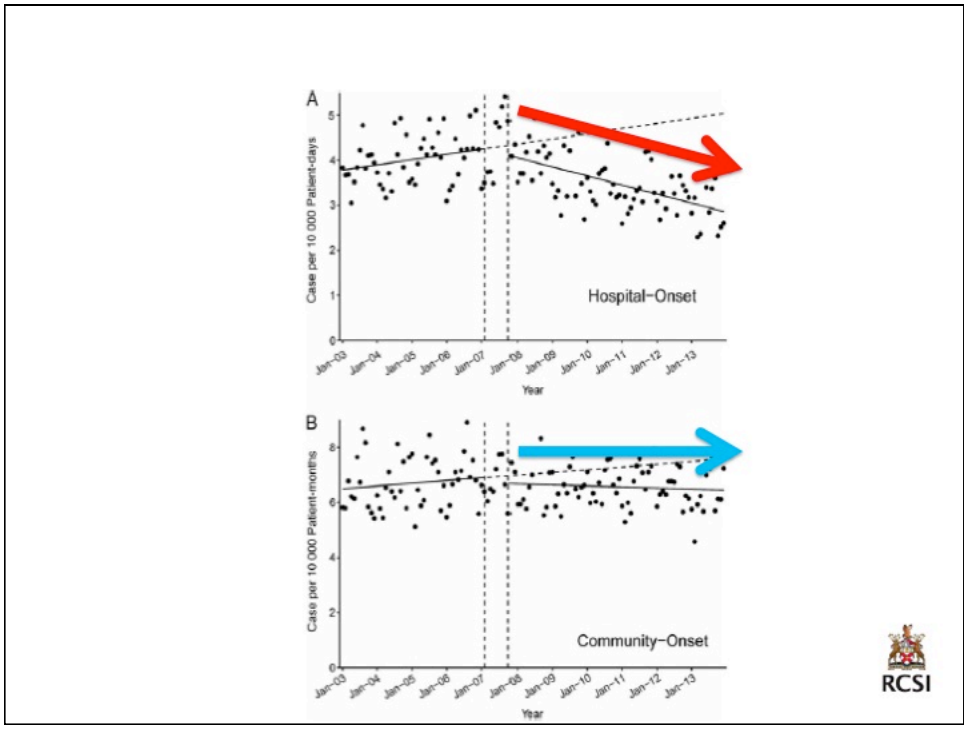
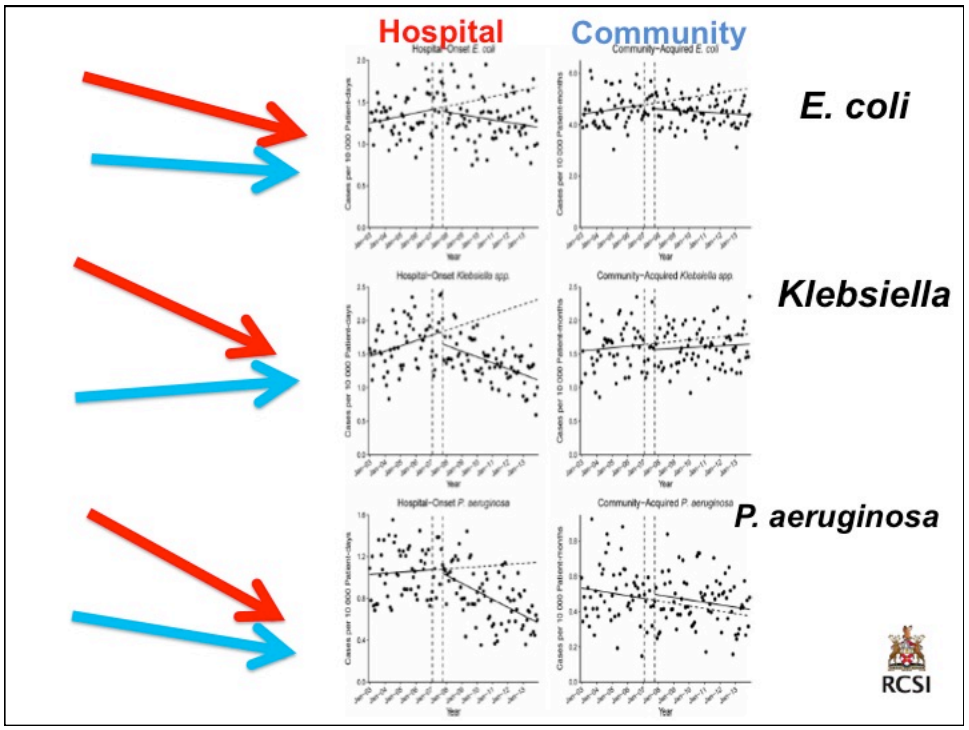
Debate – Contact Precautions are Essential for the Management of Patients with MDROs
Prof. Eli Perencevich and Dr. Fidelma Fitzpatrick
Broadcast live from the Infection Prevention Society conference (www.ips.uk.net)





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WHY DO WE NEED TO RECONSIDER?

- Confusion and lack of evidence in endemic situation for additional benefit of Contact Precautions (CP)
  - What do we actually mean by CP?
  - Lots of studies in ICU
  - No studies of CP versus none
  - Those that abandon them to date mainly US
- Possible harm associate with them
- Active screening and implementation of contact precautions costs money and time (ward / lab / IPCT / patient flow)
- What about the patients we don't screen?

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VERTICAL APPROACHES AND MDRO

- CPE / other new or unusual MDRO
- Outbreaks

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ENDEMIC MDRO

- When and where CP may provide additional *benefits* over standard precautions?
  - How?
  - Who and where?
    - All
    - High risk ??.....what is this exactly anymore??
    - Contacts?
    - Long term care
    - OPD
    - Etc etc etc

  Irl: only **55%** MDR *K. pneumoniae* isolated in 24hours of ID
- What do our patients want?
- What can we afford??
  - Screen everybody for all bugs?
  - Concentrate on doing the basics right?

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BUG OR PERSON CENTERED CARE???

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HORIZONTAL + VERTICAL APPROACHES NOT MUTUALLY EXCLUSIVE CONTEXT MATTERS

- Isolation 'fatigue'
- One size does not fit all
- CP as part of standard precautions (eg, with drainage that can't be contained, use CP).

- Decision re CP not simple (hence variation in what we actually do in practice)
  - Institutional (MDRO epidemiology /infrastructure / staffing / culture)
  - Patient population
  - Regulatory
  - Scientific (eg evidence re colonisation duration)

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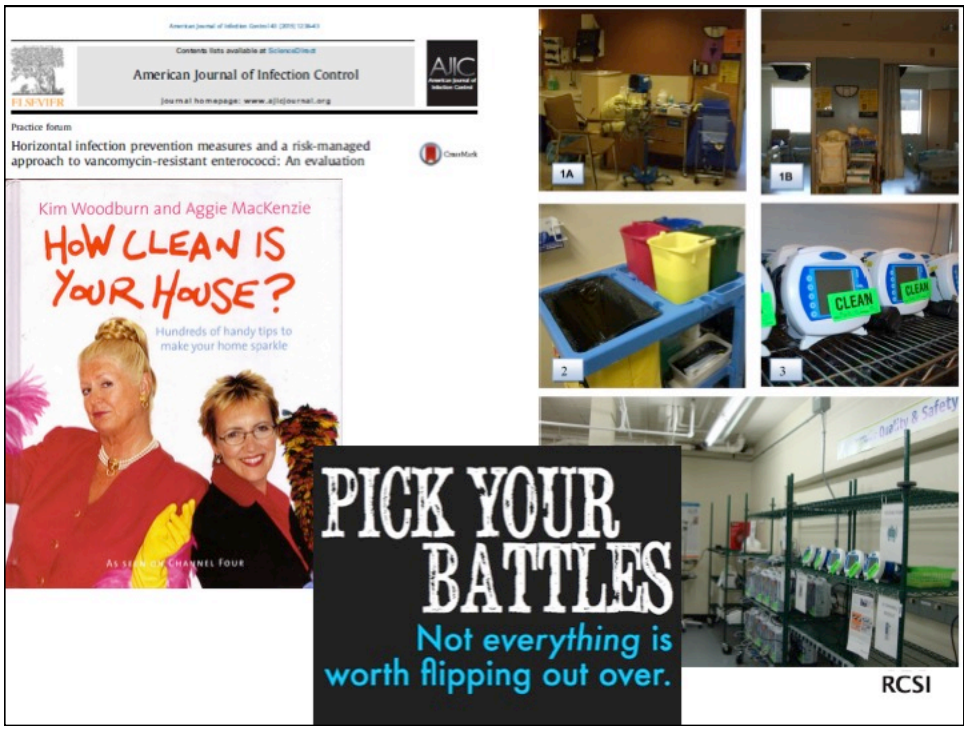

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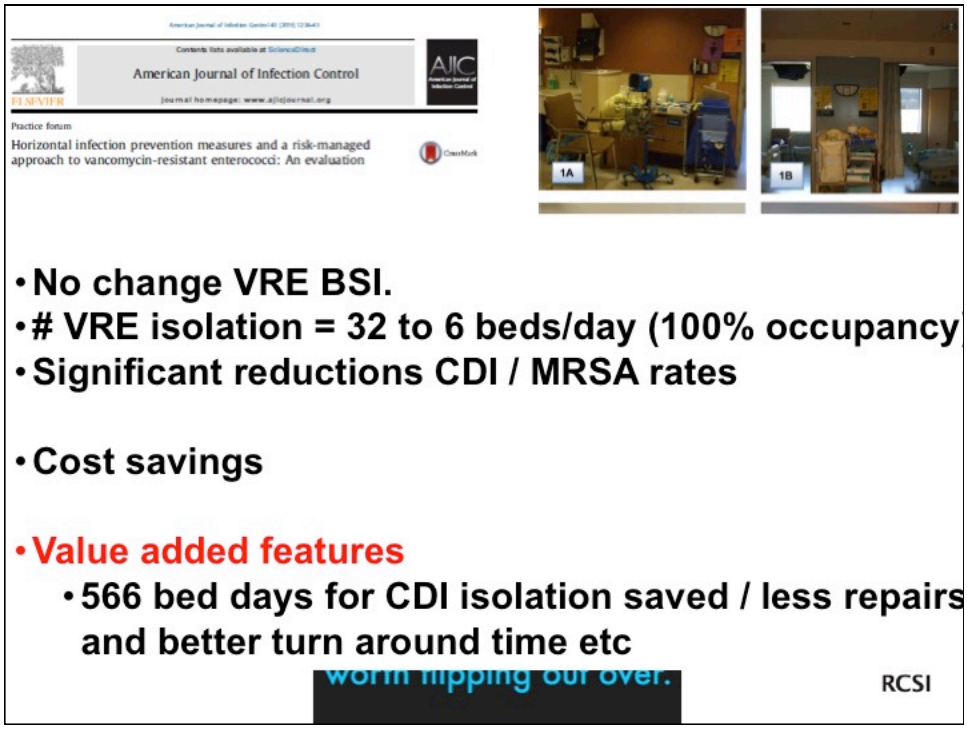
American Journal of Infection Control
Practice forum
Horizontal infection prevention measures and a risk-managed approach to vancomycin-resistant enterococci: An evaluation
1A
1B
•No change VRE BSI.
•# VRE isolation = 32 to 6 beds/day (100% occupancy
•Significant reductions CDI / MRSA rates
•Cost savings
•Value added features
•566 bed days for CDI isolation saved / less repairs and better turn around time etc
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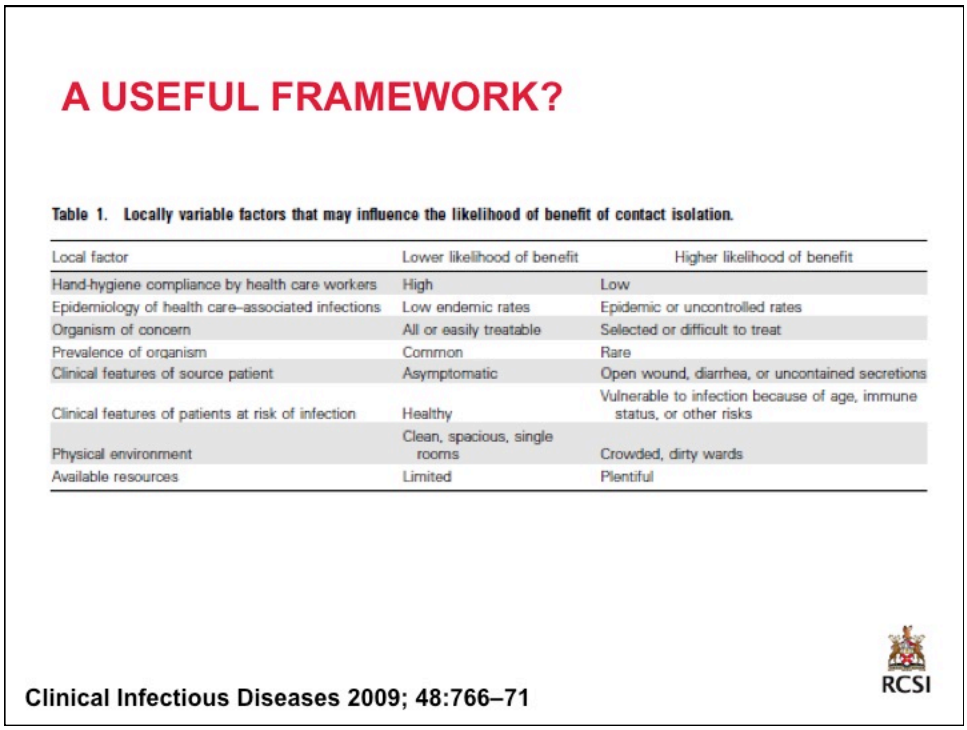
A USEFUL FRAMEWORK?
Table 1. Locally variable factors that may influence the likelihood of benefit of contact isolation.
Local factor | Lower likelihood of benefit | Higher likelihood of benefit
Hand-hygiene compliance by health care workers | High | Low
Epidemiology of health care–associated infections | Low endemic rates | Epidemic or uncontrolled rates
Organism of concern | All or easily treatable | Selected or difficult to treat
Prevalence of organism | Common | Rare
Clinical features of source patient | Asymptomatic | Open wound, diarrhea, or uncontained secretions
Clinical features of patients at risk of infection | Healthy | Vulnerable to infection because of age, immune status, or other risks
Physical environment | Clean, spacious, single rooms | Crowded, dirty wards
Available resources | Limited | Plentiful
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Clinical Infectious Diseases 2009; 48:766–71

FOR YOUR CONTEXT THINGS TO CONSIDER

- **Resources**
  - Infrastructure
  - Ward and infection control staffing
  - Laboratory capability
- **Outbreak or endemic or unusual/rare MDRO**
- **MDROs are not all the same**
  - Epidemiological reservoir
  - Potential to cause outbreaks
  - Environmental survival
  - Evidence to support contact precautions in the endemic setting
- **Your transmission rates**
- **The patient!**
  - Benefits vs. potential harm

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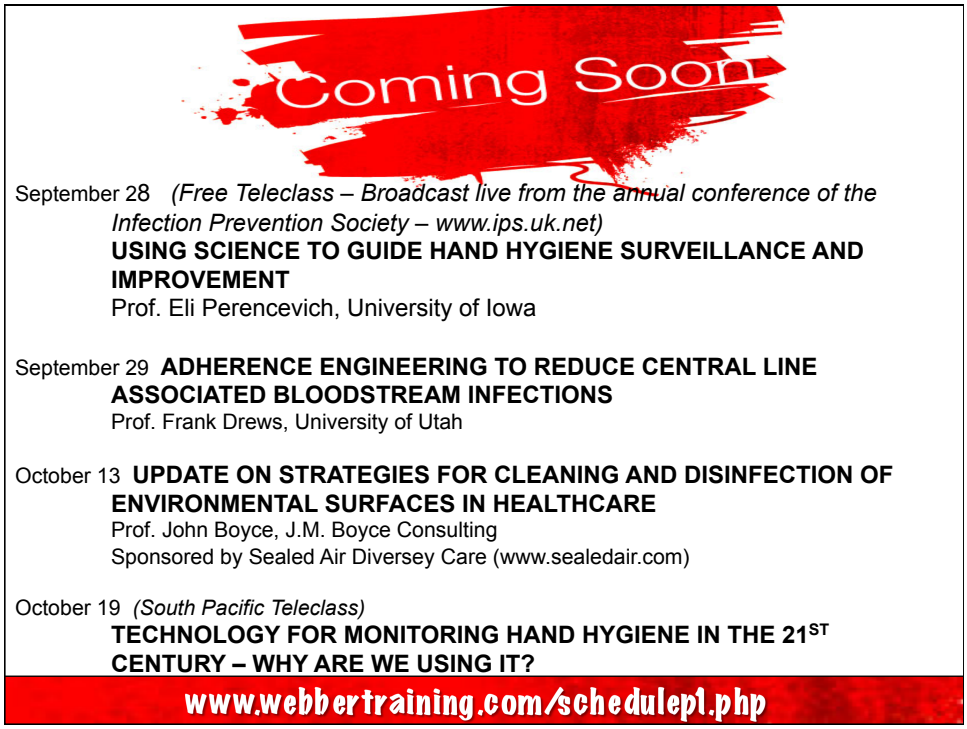

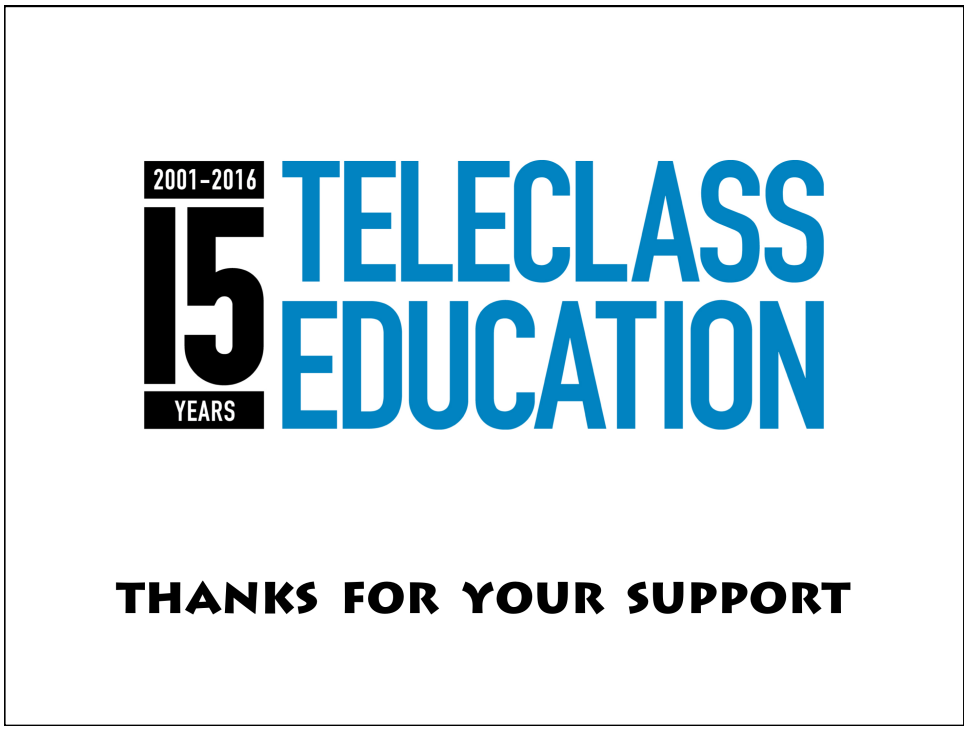

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