

Contact Precautions for MRSA and VRE: Out of Fashion or Prevention Worth Wearing?

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LIFE CHANGING MEDICINE

Disclosures

No relevant financial relationships to disclose

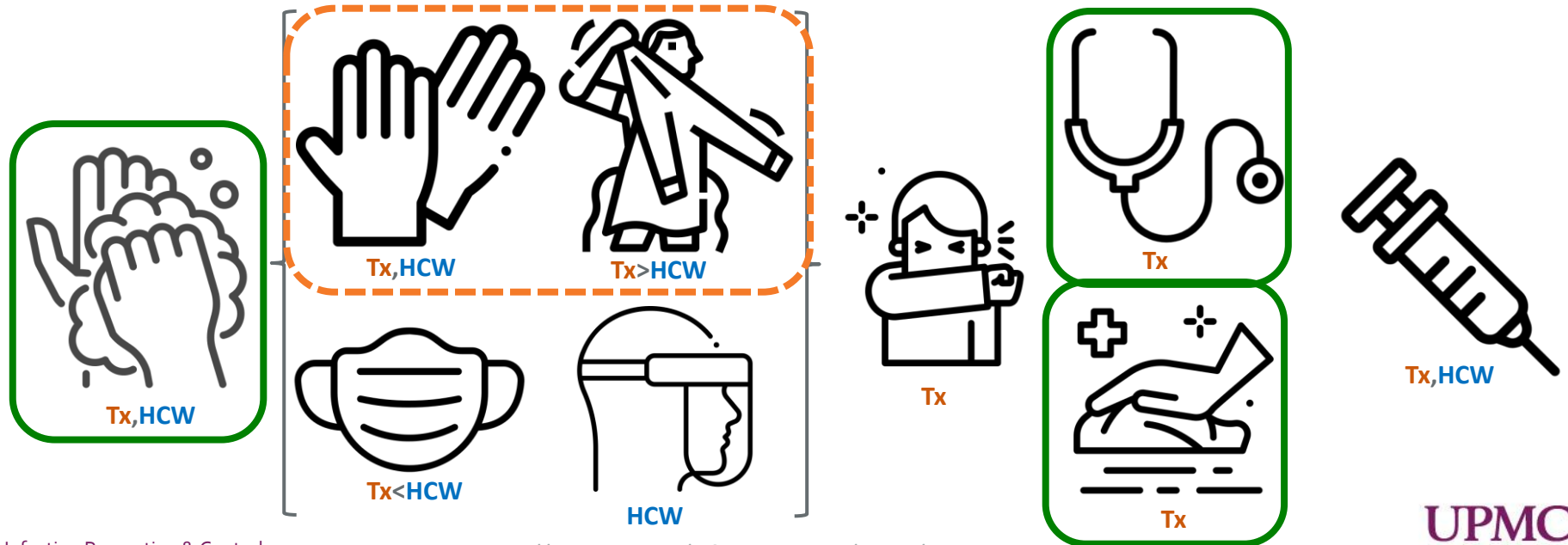
Learning Objectives

1. Understand the mechanisms of transmission for methicillin-resistant *Staphylococcus aureus* (MRSA) and vancomycin-resistant Enterococci (VRE)
2. Summarize the published evidence for use of contact precautions, and discontinuation of contact precautions, to prevent healthcare-associated infections due to MRSA and VRE
3. Define a risk-tailored approach to use of transmission-based precautions to prevent transmission of MRSA and VRE.

To understand the *incremental* value of contact precautions, we must define the “fundamentals”

Standard precautions applies to all patient encounters – and likely affords substantial protection

Universal and situation-dependent transmission prevention measures, not dependent upon microbiologic diagnosis



Transmission-based precautions requires knowledge of pathogen carriage



*Disease-specific
or
Category-specific*

Strict
Respiratory
Protective
Enteric
Wound and Skin
Discharge
Blood

Strict
Respiratory
AFB
Enteric
Contact
Drainage/Secretion
Blood and Body Fluids

Body substance isolation

Blood and Body Fluids
+
Universal Precautions

*Transmission-based
precautions*

Droplet
Airborne
Contact

+

Standard Precautions

1970

1983

1985-88

1996

The current transmission-based model presents challenges to implementation

- Translating clinical assessment and/or testing to appropriate signage
- Visibility of signage
- Availability of personal protective equipment (PPE)
- Waste disposal (+/- laundering “cost”)
- Suboptimal adherence and incorrect use

Theoretical reasons why transmission-based precautions may be counter-productive

- Mental burden of PPE use, without visualization of consequences of non-adherence
- Conscious risk assessment and protective action versus subconscious behavior
- Risk of increased contamination with misuse
- “Knowing more” may not equal better/safer patient care
- Potential adverse risks to patient: frequency of care, adverse events, psychological impact

Type and Duration of Precautions Recommended for Selected Infections and Conditions¹

Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings (2007)

A

Infection/Condition	Type of Precaution	Duration of Precaution	Precautions/Comments
Viral hemorrhagic fevers due to Lassa, Ebola, Marburg, Crimean-Congo fever viruses	Droplet + Contact + Standard	Duration of illness	Ebola Virus Disease for Healthcare Workers [2014]  Update: Recommendations for healthcare workers can be found at Ebola For Clinicians . (accessed September 2018). Single-patient room preferred. Emphasize: 1. use of sharps safety devices and safe work practices,
Respiratory syncytial virus infection, in infants, young children and immunocompromised adults	Contact + Standard	Duration of illness	Wear mask according to Standard Precautions [24] CB [116, 117]. In immunocompromised patients, extend the duration of Contact Precautions due to prolonged shedding [928]. Reliability of antigen testing to determine when to remove patients with prolonged hospitalizations from Contact Precautions uncertain.

Why we should believe in the effectiveness of contact precautions to reduce transmission

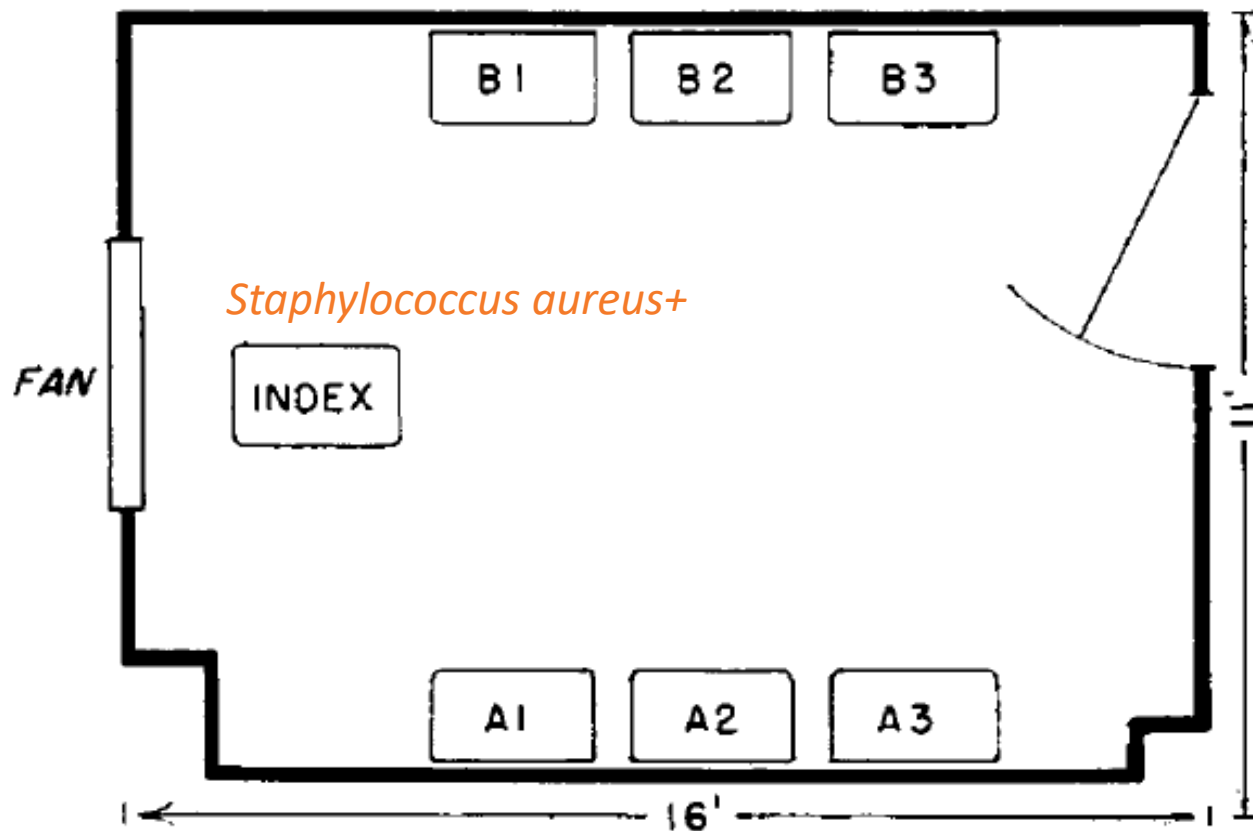
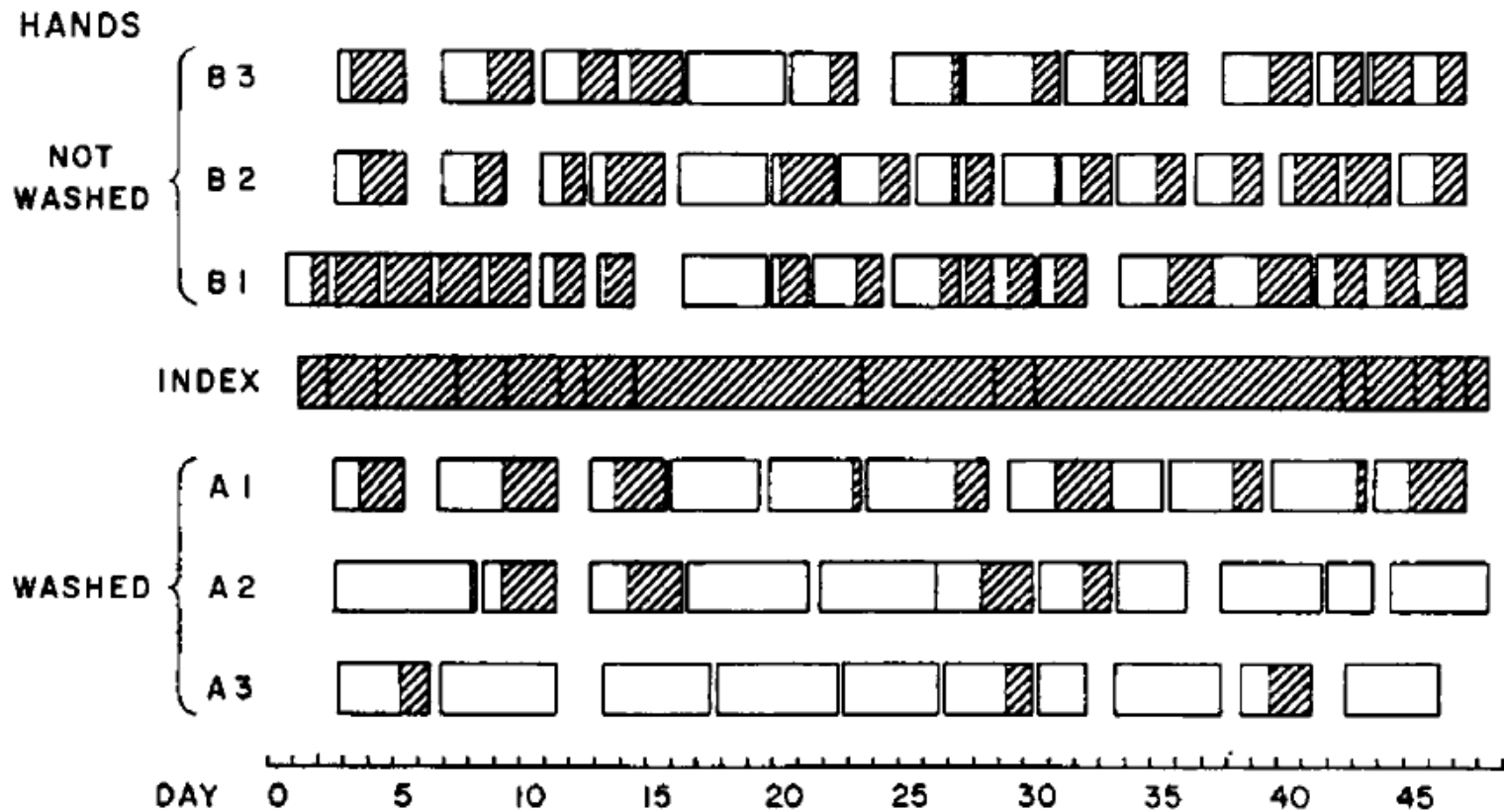


Fig. 1.—Plan of study nursery.

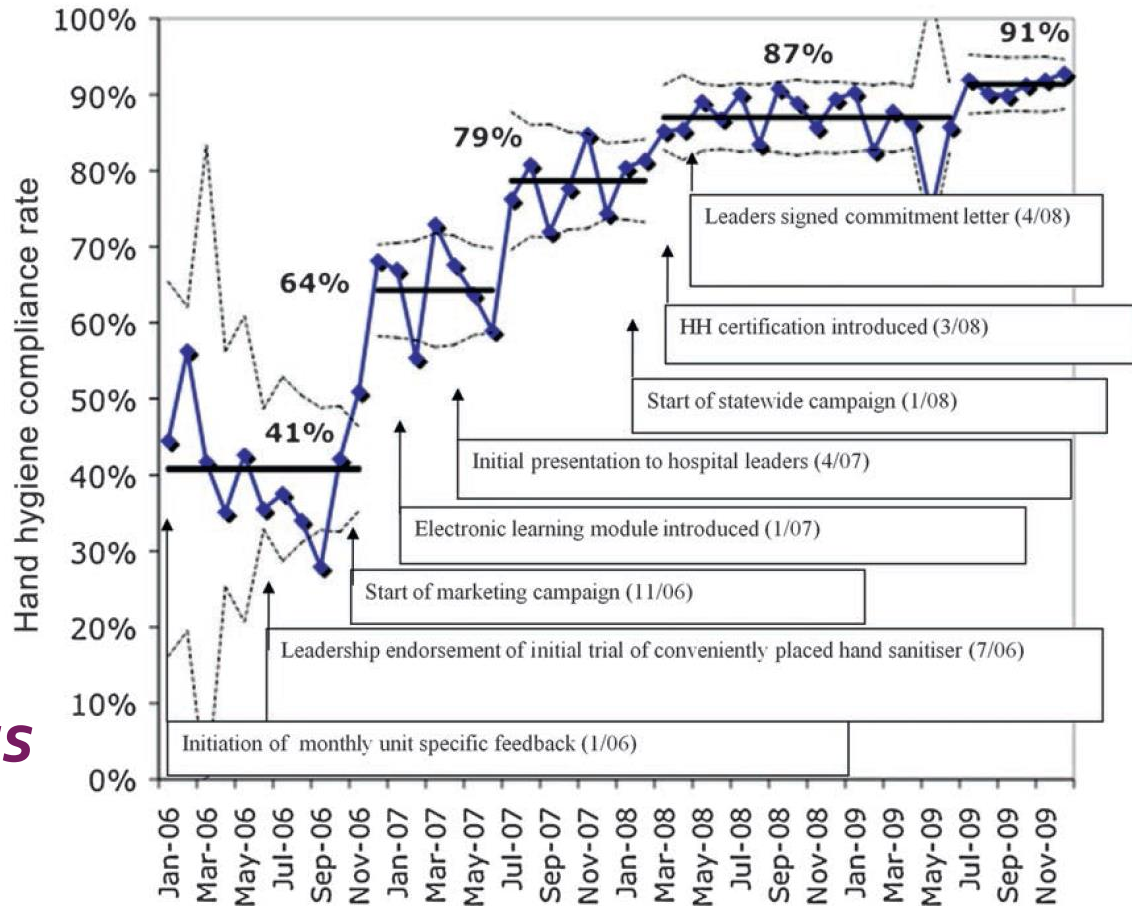


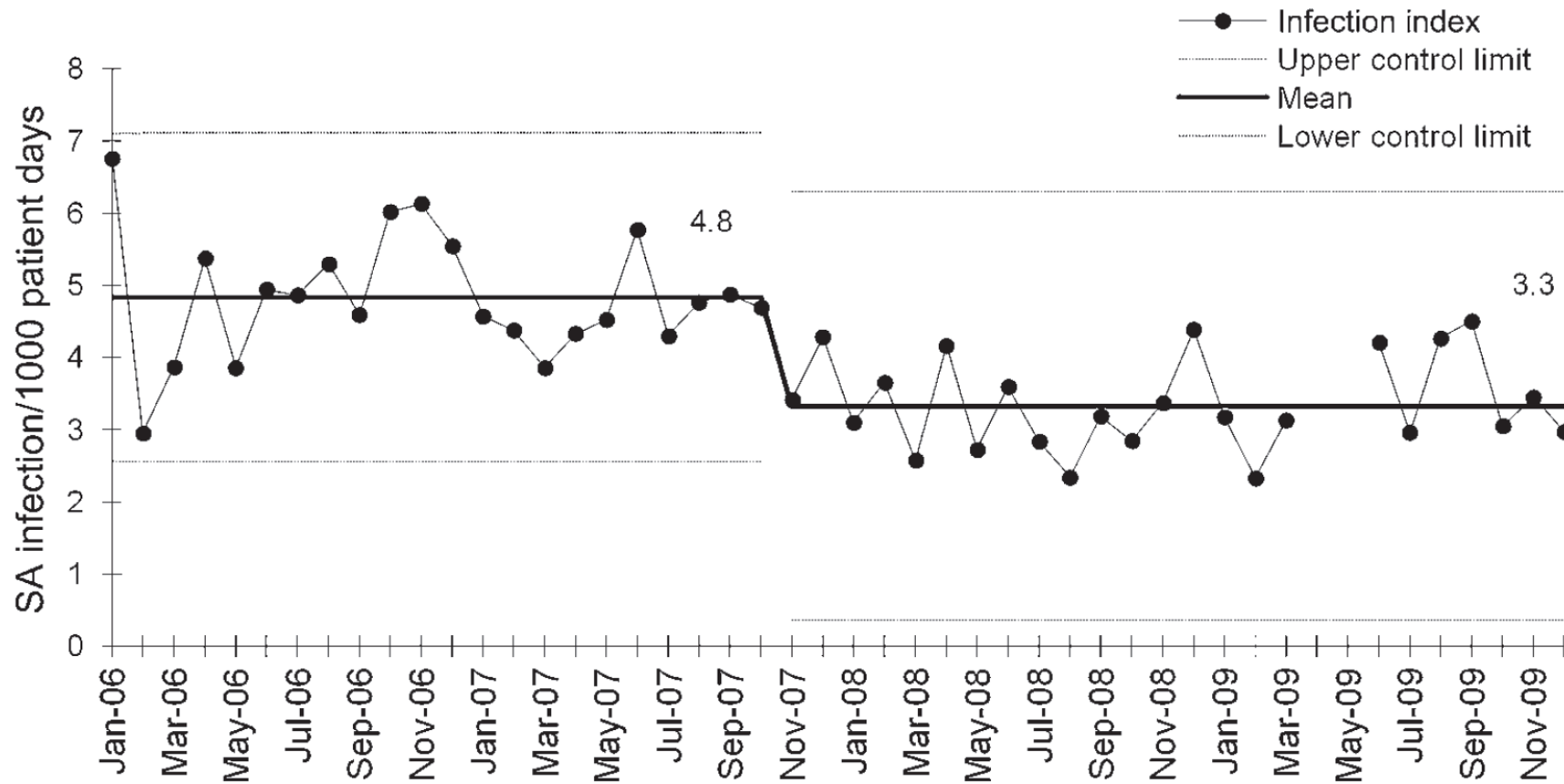
Study Group	N	<i>S.aureus</i> acquisitions	Hours exposed	Frequency of acquisition	Rate of acquisition (/100 hours)
A = handwashing	32	17	2,265	53.1%	0.75
B = no handwashing	49	45	1,578	91.8%	2.85

Risk Ratio:	Incidence Rate Ratio:
1.73 (1.24-2.42)	3.80 (2.18-6.64)

Handwashing reduced the risk of transmitting *S. aureus* by 40-75%

Studies continue to demonstrate the importance of hand hygiene (and ergo contact route) in the prevention of *S. aureus*





Personal protective equipment becomes contaminated during patient care – ICU, MRSA & VRE

TABLE 1. Rates of Detection of Methicillin-Resistant *Staphylococcus aureus* (MRSA) and Vancomycin-Resistant Enterococci (VRE) on the Gowns and Gloves Worn by Healthcare Workers Caring for Patients with MRSA and VRE Carriage

Sample cultured	Patients with MRSA carriage		Patients with VRE carriage	
	Proportion of observations	Percentage of observations (95% CI)	Proportion of observations	Percentage of observations (95% CI)
Gloves	14/79	17.7 (9.3–26.1)	7/91	7.7 (2.2–13.2)
Gown	5/81	6.2 (1–11.4)	4/94	4.3 (0.2–8.4)
Gloves and/or gown	15/81	18.5 (10–27)	8/94	8.5 (2.9–14.1)
Hands after removing gloves and gown	2/78	2.6 (–0.9 to 6.1)	0/94	0

NOTE. For some interactions, gown or glove samples could not be obtained, so the total number of observations varies. CI, confidence interval.

Personal protective equipment becomes contaminated during patient care – ICU, MRSA

PPE sampled	Contam %
Gloves	14.2% (570/3982)
Gowns	5.9% (233/3980)
Gloves and/or gown	16.2% (644/3982)

Type of Healthcare Personnel (N = 3982)	Number of Gloves or Gowns With MRSA/Number of Observations (% Gloves or Gowns With MRSA)	Odds Ratio (95% Confidence Interval)
Occupational/physical therapist	27/83 (32.5)	6.96 (3.51, 13.79)
Respiratory therapist	87/322 (27.0)	5.34 (3.04, 9.39)
Nurse	404/2292 (17.6)	3.09 (1.84, 5.19)
Patient care technician	36/293 (12.3)	2.02 (1.09, 3.74)
Medical doctor/nurse practitioner	61/541 (11.3)	1.83 (1.04, 3.25)
Environmental services	13/204 (6.4)	0.98 (0.46, 2.09)
Other ^a	16/247 (6.5)	Ref

Domain Touched (N = 3982)	Number of Gloves or Gowns With MRSA/Number of Observations (% Gloves or Gowns With MRSA)	Odds Ratio (95% Confidence Interval)
Contamination of gloves or gowns		
Any patient contact ^a	594/3274 (18.1)	2.59 (1.04, 6.51)
Environment only	45/620 (7.3)	1.13 (0.43, 3.00)
Nothing	5/88 (5.7)	Ref

Personal protective equipment becomes contaminated during patient care – non-ICU, MRSA

PPE sampled	Contam %
Gloves	3.1% (16/517)
Gowns	3.5% (18/517)
Gloves and/or gown	5.4% (28/517)

Variable	Transmission of MRSA to HCP Glove or Gown		Adjusted OR (95% CI) ^a
	Yes, No. (%)	No No. (%)	
HCP type			
Direct patient care ^b	26 (6.4)	378 (93.6)	3.93 (0.89–17.44)
No direct patient care ^c	2 (1.8)	111 (98.2)	Ref
MRSA bacterial bioburden			
Detected ^d	9 (9.3)	88 (90.72)	2.84 (1.02–7.87)
Not detected ^e	11 (3.6)	299 (96.5)	Ref

Personal protective equipment becomes contaminated during patient care – ICU, VRE

PPE sampled	Contam %
Gloves	13.0% (61/469)
Gowns	6.2% (29/469)
Gloves and/or gown	15.1% (71/469)

HCW Type (N = 469)	HCW-Patient Interactions, No. (%)	OR (95% CI) ^a
Nurse	236 (50)	4.74 (1.63–13.77)
MD/nurse practitioner	70 (15)	4.26 (1.06–17.18)
Respiratory technician	37 (8)	3.15 (0.64–15.54)
Patient care technician	18 (4)	7.57 (1.80–31.79)
Occupational/physical therapist	12 (3)	8.66 (1.36–55.05)
Environmental services and other ^b	96 (20)	Reference

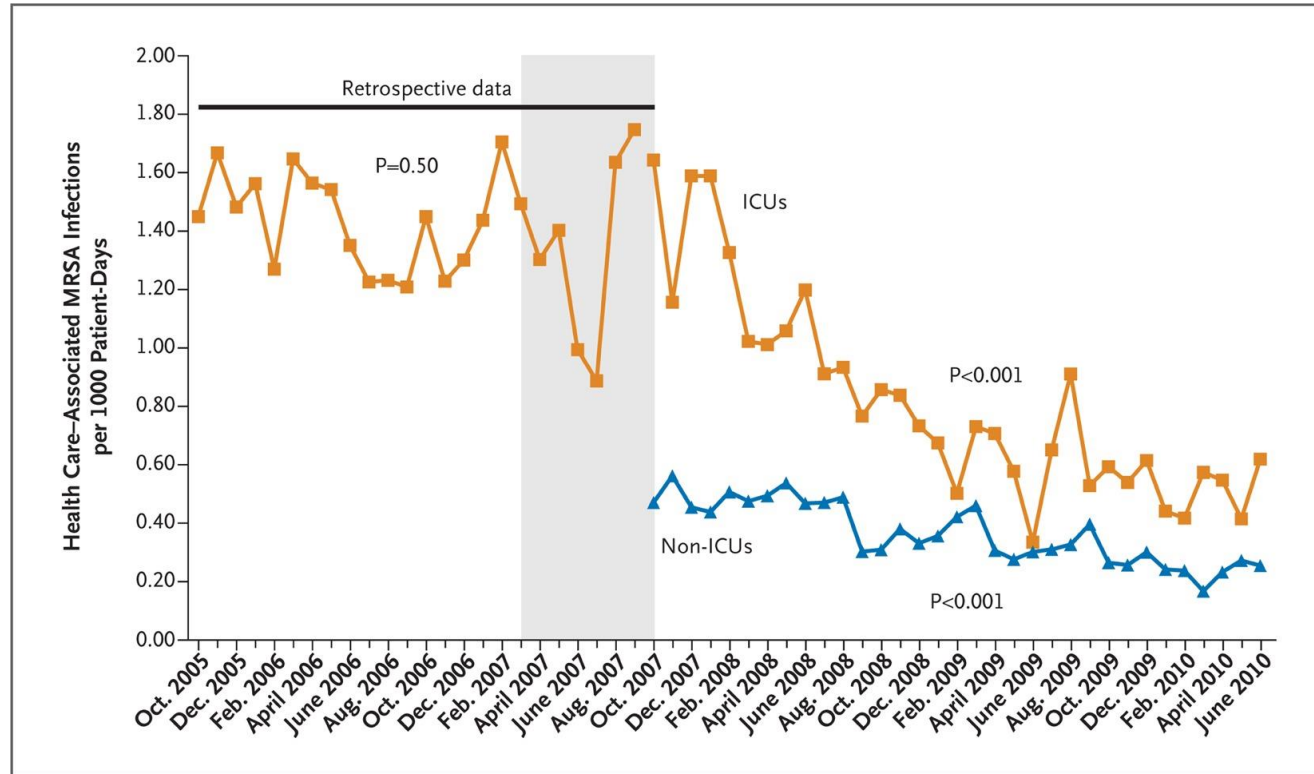
Variation in PPE contamination could tailor transmission prevention effectiveness

- Contamination of gowns, gloves, or both with MRSA and VRE are common during care for MDRO carriers
- Consistent risk factors include:
 - Time in room
 - ICU > non-ICU
 - Nature of care: Respiratory, wound/hygiene, devices
 - Contact with patient domain > environmental domain
 - Bacterial burden on the patient

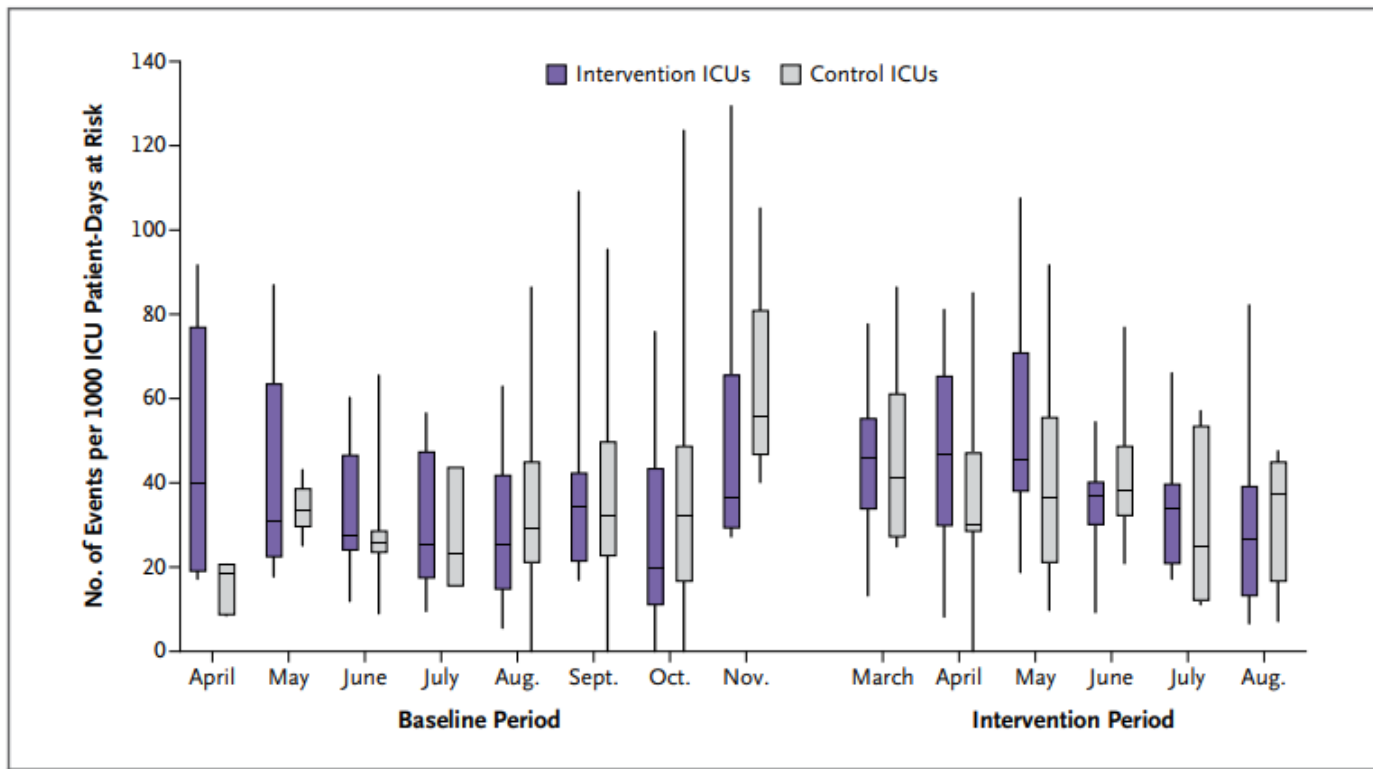
What methodologically robust studies suggest about effectiveness of contact precautions

The nationwide Veterans Administration “MRSA bundle” was persuasively successful

- Leadership buy-in
- “Positive deviance” culture change
- Resources (education, lab, et al)
- Data transparency
- Hand hygiene
- MRSA prevention coordinator
- Active surveillance
- **Contact precautions**



Active surveillance and contact precautions for MRSA and VRE did not reduce transmission (STAR*ICU)



ICU universal gowning and gloving did not result in reduction in {MRSA or VRE} acquisition (BUGG)

Table 2. Rates at Risk of Acquisition of Antibiotic-Resistant Bacteria per 1000 Patient-Days

	Intensive Care Units						P Value ^c
	Intervention			Control			
	No. of Acquisitions	Patient-Days at Risk	Mean Rate (95% CI) ^a	No. of Acquisitions	Patient-Days at Risk	Mean Rate (95% CI) ^a	
Drug-Resistant Bacteria							
VRE or MRSA							
Study period	577	32 693.0	16.91 (14.09 to 20.28)	517	31 765.0	16.29 (13.48 to 19.68)	
Baseline	178	8684.0	21.35 (17.57 to 25.94)	176	9804.5	19.02 (14.20 to 25.49)	
Change ^d			−4.47 (−9.34 to 0.45)			−2.74 (−6.98 to 1.51)	−1.71 (−6.15 to 2.73) .57
VRE							
Study period	411	27 765.5	13.59 (10.26 to 17.99)	337	28 340.5	11.88 (8.65 to 16.33)	
Baseline	108	7691.5	15.18 (10.50 to 21.95)	122	8818.0	14.37 (10.31 to 20.02)	
Change ^d			−1.60 (−7.18 to 3.98)			−2.48 (−5.53 to 0.56)	0.89 (−4.27 to 6.04) .70
MRSA							
Study period	199	30 454.5	6.00 (4.63 to 7.78)	191	30 024.0	5.94 (4.59 to 7.67)	
Baseline	77	7841.0	10.03 (8.05 to 12.50)	59	9182.0	6.98 (4.50 to 10.83)	
Change ^d			−4.03 (−6.50 to −1.56)			−1.04 (−3.37 to 1.28)	−2.98 (−5.58 to −0.38) .046

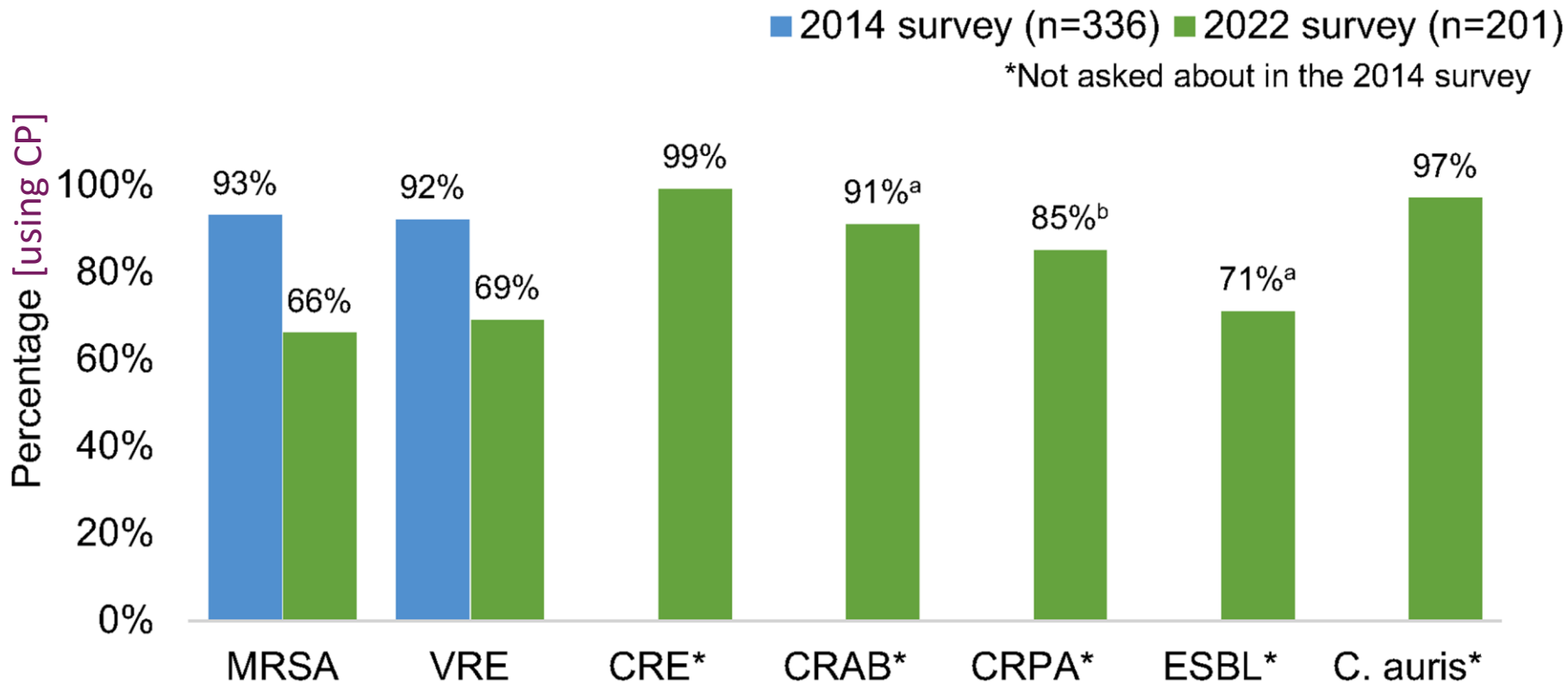
There is a good circumstantial case for the effectiveness of contact precautions.

Nevertheless, it became *de rigueur* to discontinue contact precautions (DcCP).

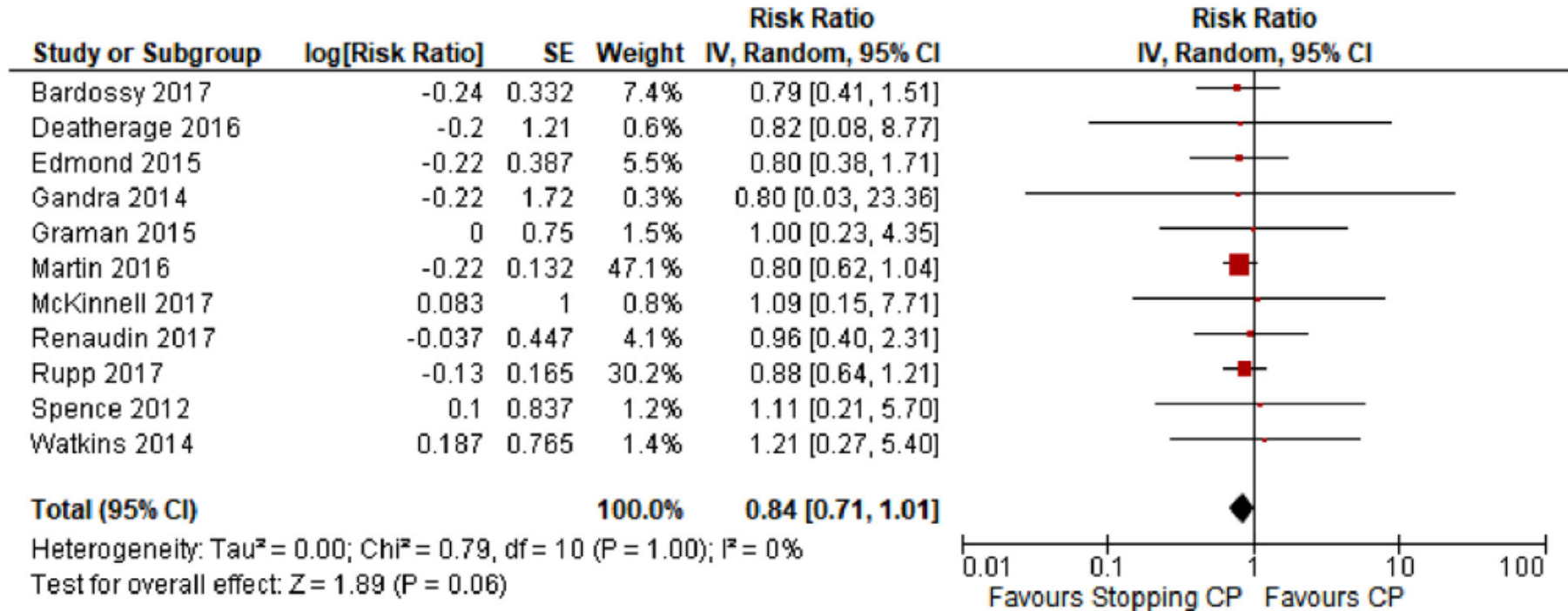
Hospitals began discontinuation of CP around 2010

Institution (number of hospitals)	Use of contact precautions				Year foregoing CP
	MRSA	VRE	<i>C. difficile</i>	MDR-GNR	
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) ²	No	No	Yes ^b	Yes	2003
Dartmouth MC ²	No	No	Yes ^b	Yes	Prior to 2003
Hospitals that use decolonization of patients identified to have <i>S. aureus</i> (including MRSA)^c					
Cleveland Clinic (10 hospitals)	No	No	Yes	Yes	Prior to 2003

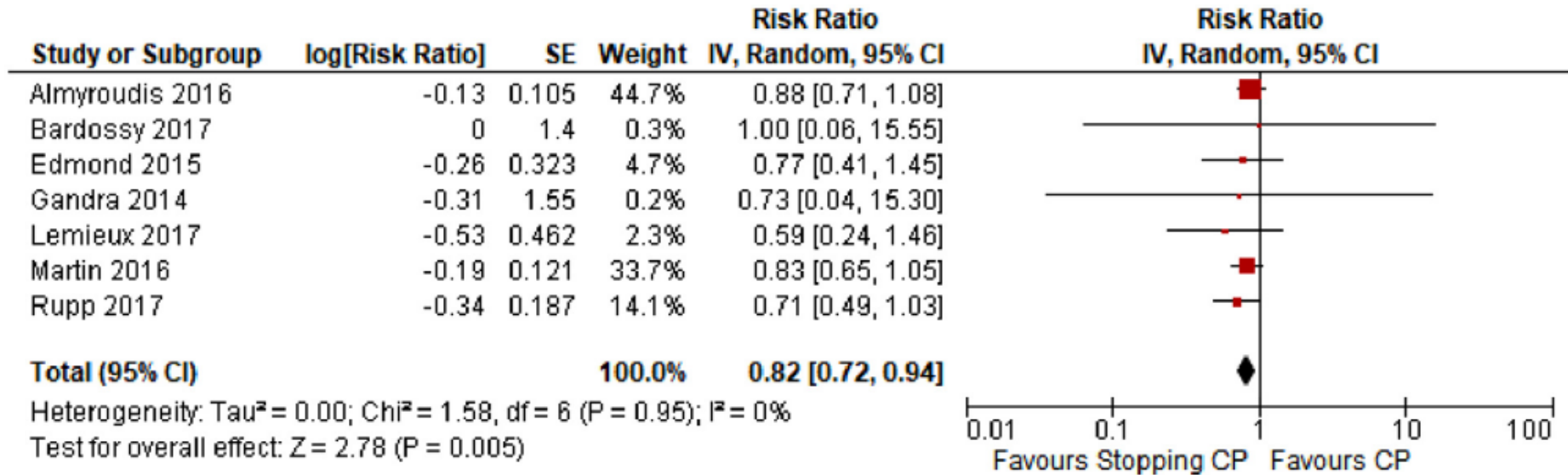
The trend in discontinuation of CP continues...



Methodologically limited studies show no change (to benefit?) in MRSA infection rates after DcCP



Methodologically limited studies suggest a modest *decrease* in VRE infection rates after DcCP



Testing the counterfactual – and proving the relationship between intervention and outcome – does not require RCTs

Schweizer ML, Infect Control Hosp Epi
2016;37:1135

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TABLE 2. Major Quasi-Experimental Design Types and Subtypes

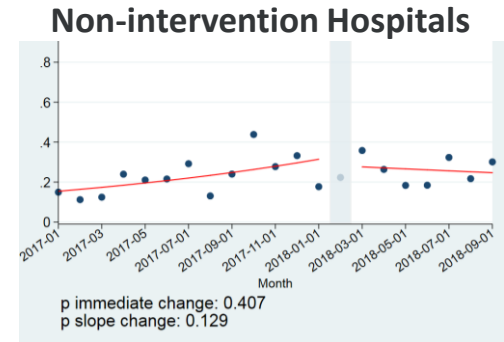
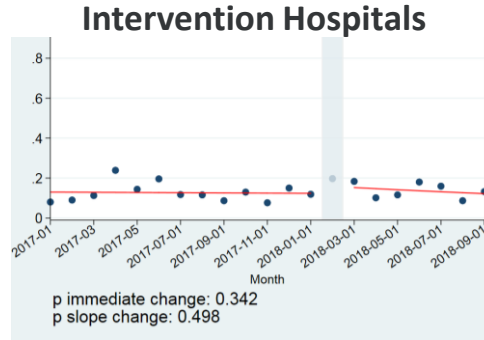
Type and Subtype	Description	Notation
A. INTERRUPTED TIME-SERIES QUASI-EXPERIMENTAL DESIGNS		
15	Interrupted time series that uses switching replications and a control group	<u>A1c A2c A3c X A4t A5t A6t removeX A7c A8c A9c A10c</u> B1c B2c B3c B4c B5c B6c X B7t B8t B9t B10t
14	Interrupted time series with repeated treatment design ¹³	A1c A2c A3c X A4t A5t removeX A6c A7c X A8t A9t
13	Interrupted time series removing the treatment at a known time	A1c A2c A3c A4c X A5t A6t A7t A8t removeX A9c A10c
12	Interrupted time series with a nonequivalent dependent variable ¹⁴	(A1c ^v , A1c ⁿ) (A2c ^v , A2c ⁿ) (A3c ^v , A3c ⁿ) X (A4t ^v , A4t ⁿ) (A5t ^v , A5t ⁿ)
11	Interrupted time series with an untreated control group ¹²	<u>A1c A2c A3c A4c A5c X A6t A7t A8t A9t A10t</u> B1c B2c B3c B4c B5c B6c B7c B8c B9c B10c
10	Simple interrupted time series ^{11,15}	A1c A2c A3c A4c A5c X A6t A7t A8t A9t A10t
B. QUASI-EXPERIMENTAL DESIGNS THAT USE CONTROL GROUPS		
9	The control group design that uses dependent pretest and posttest samples and switching replications	<u>A1c X A2t removeX A3c</u> B1c B2c X B3t
8	The untreated-control group design that uses dependent pretest and posttest samples and a double pretest	<u>A1c A2c X A3t</u> B1c B2c B3c
7	The untreated control group design that uses dependent pretest and posttest samples	<u>A1c X A2t</u> B1c B2c
6	The posttest-only design that uses an untreated control group	<u>X A1t</u> B1c
C. QUASI-EXPERIMENTAL DESIGNS THAT DO NOT USE CONTROL GROUPS		
5	The repeated-treatment design	A1c X A2t removeX A3c X A4t
4	The removed-treatment design	A1c X A2t A3t removeX A4c
3	The 1-group, pretest-posttest design that uses a nonequivalent dependent variable	(A1c ^v , A1c ⁿ) X (A2t ^v , A2t ⁿ)
2	The 1-group, pretest-posttest design that uses a double pretest	A1c A2c X A3t
1	The 1-group, pretest-posttest design	A1c X A2t

NOTE. Classification types adapted prior publications^{1,2}; A = primary group of interest; B = control group; 1,2,3, etc. = observations for a Group; X = intervention; remove X = remove intervention; ^v = variable of interest; ⁿ = non-equivalent dependent variable; t = treatment group; c = no treatment. Time moves from left to right. Citations are published examples from the literature.

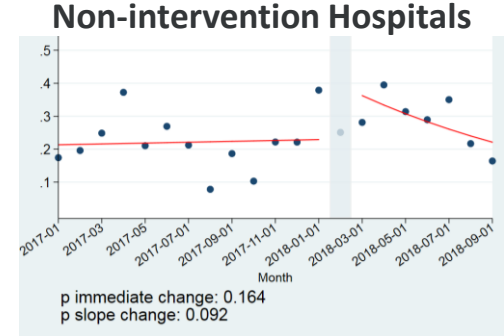
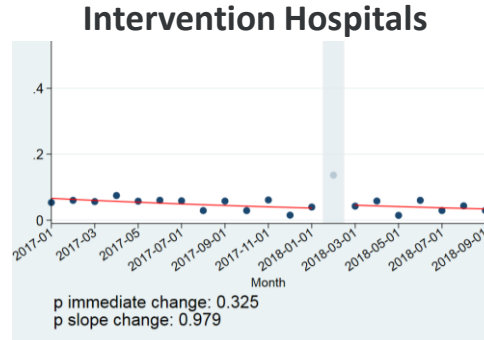
The future holds a more complete assessment and nuanced perspective of contact precautions

In a multi-facility health system, we found no change in MRSA or VRE HAI rates after DcCP

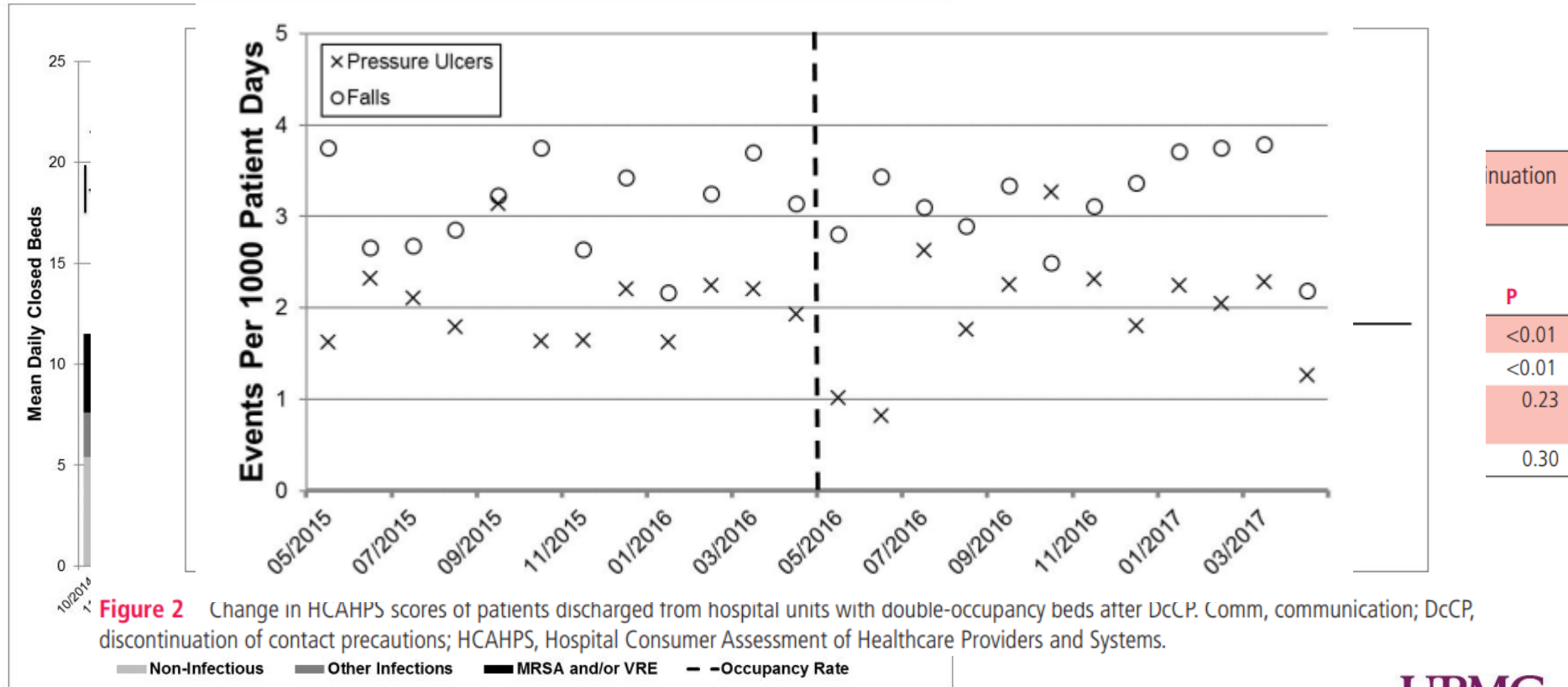
MRSA HAI Per 10,000 Patient Days



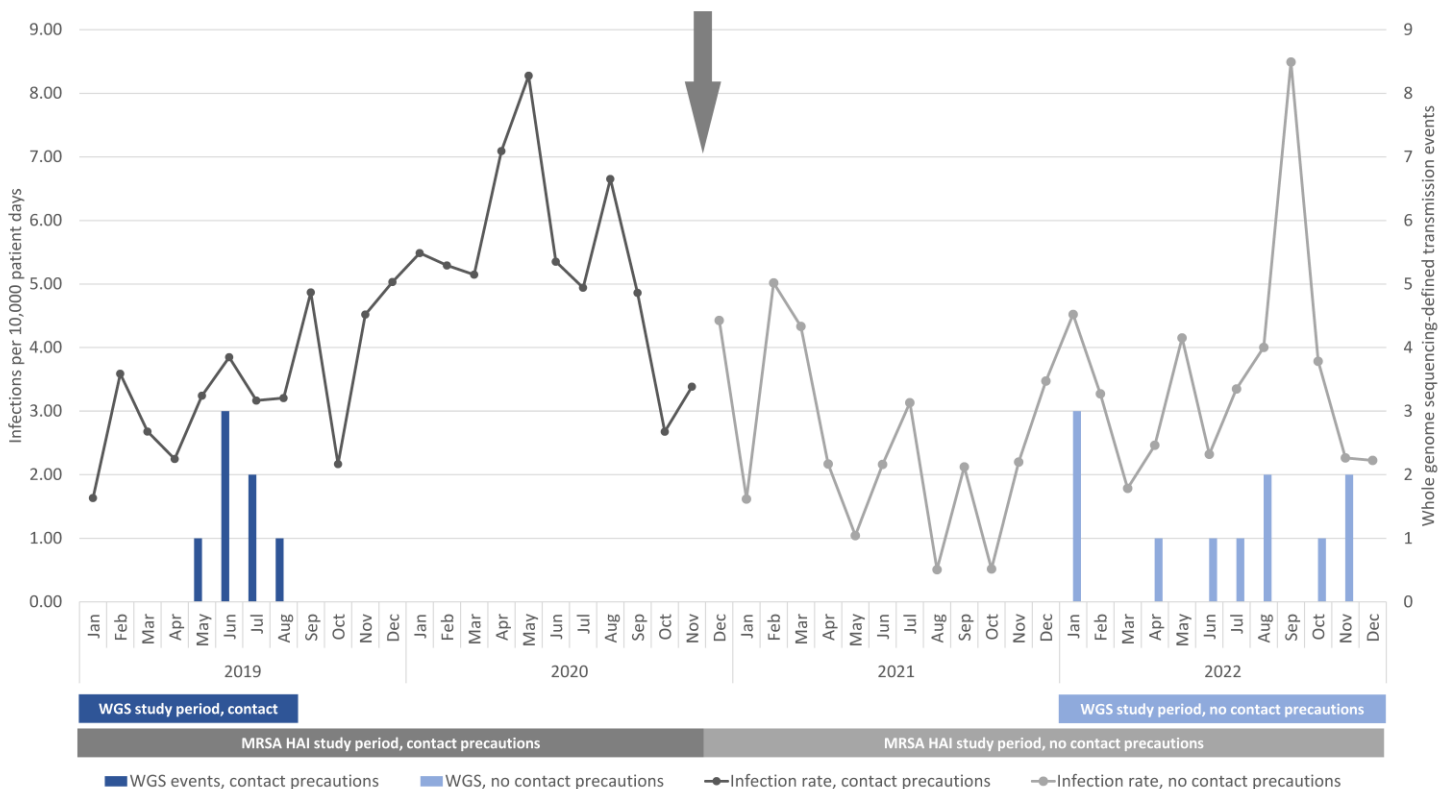
VRE HAI Per 10,000 Patient Days



Health systems should consider metrics beyond summary HAI or acquisition metrics



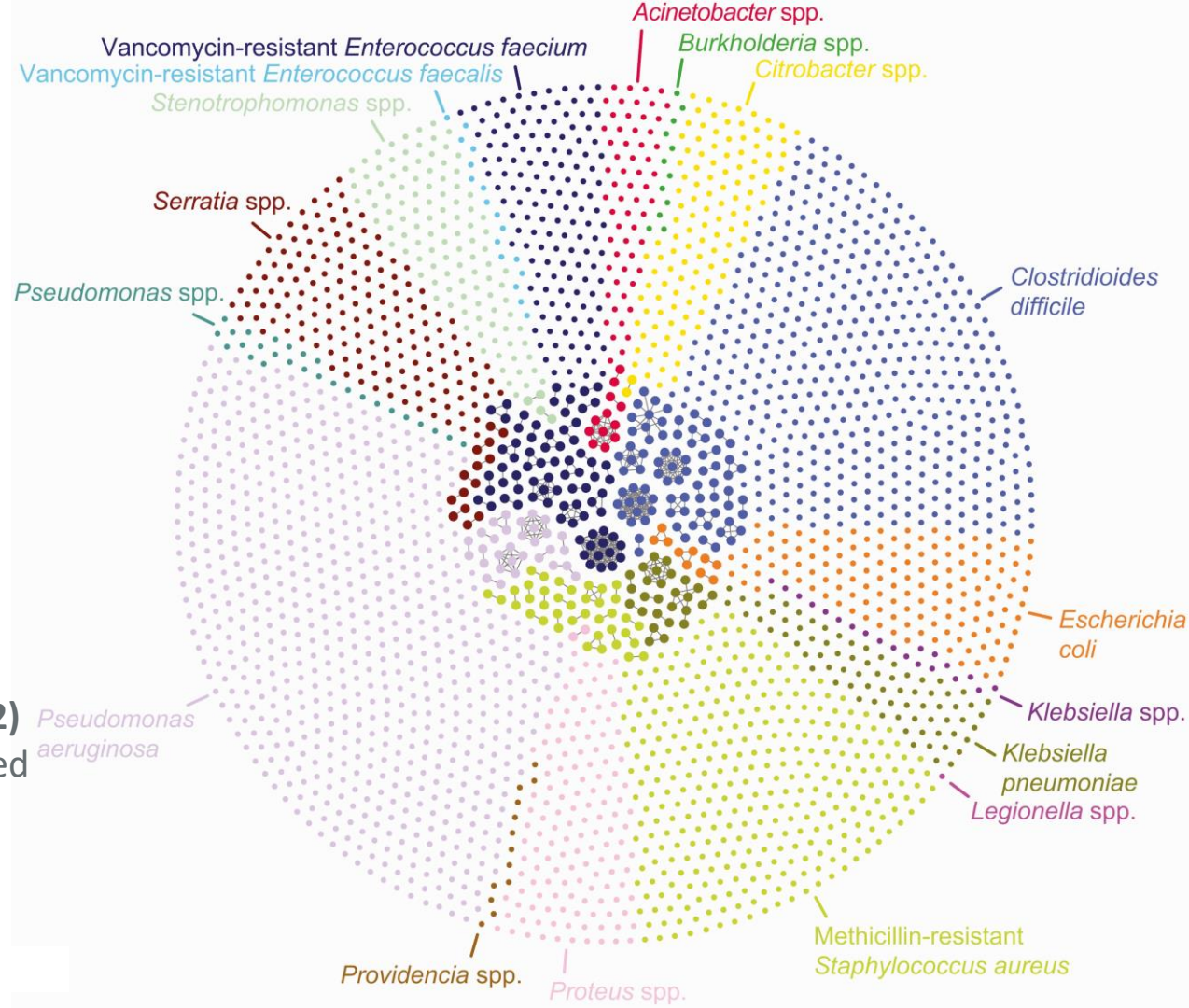
An HAI or acquisition measure *may not* adequately estimate contact precaution-preventable transmission



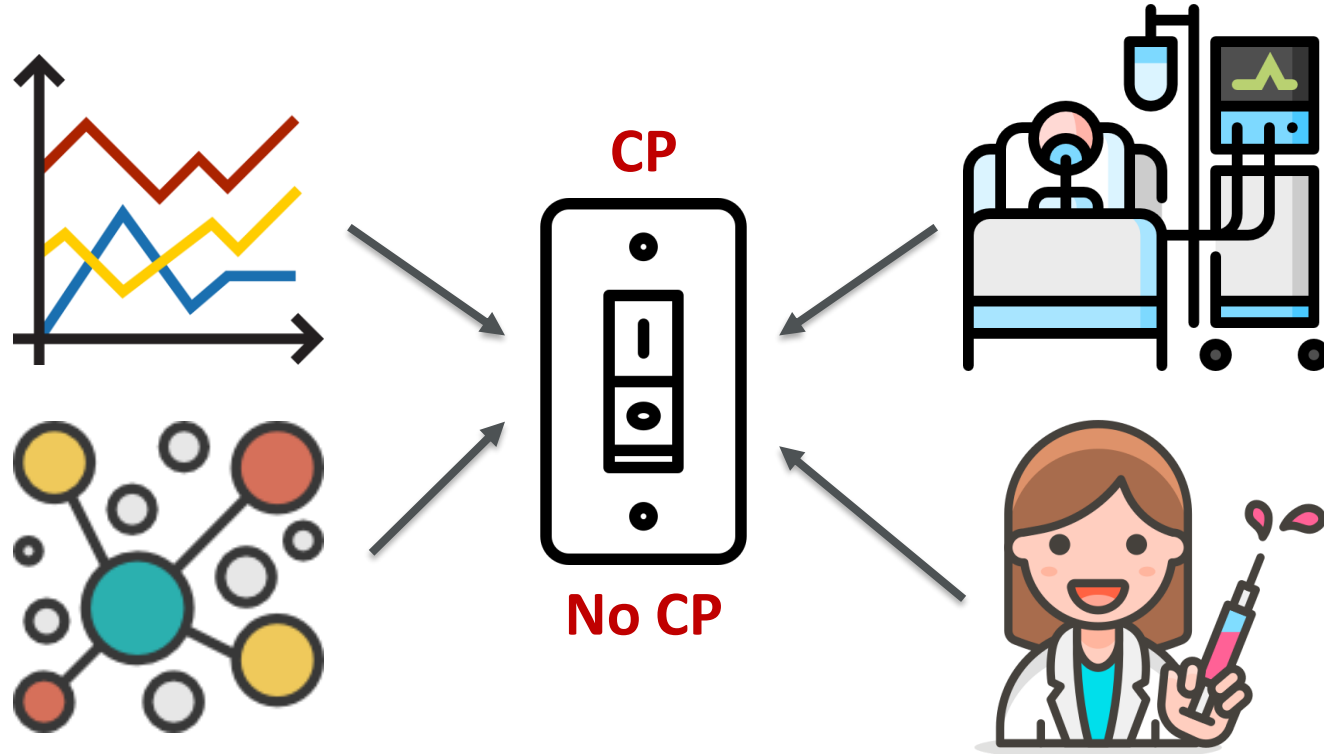
Hospital “acquisition” represents more than HAI or new colonization alone

MRSA: 10.7% (39/365) unique patient isolates were related to another hospital isolate, in 18 clusters

VRE (*E.faecium*): 10.8% (297/2752) unique patient isolates were related to another isolate, in 24 clusters
(*E.faecalis*: 0/17 isolates)



The future may be risk-tailored deployment of CP: Anticipate change + robust analysis



Healthcare workers may be amenable to a risk-tailored approach...

Table 1. Summary of most frequently mentioned themes by healthcare personnel related to contact precautions for patients with MRSA

	Frequency
Risk-tailored approach to PPE	
• Open to a risk-tailored approach	10
• Concern risk-tailored is too complicated/confusing	8
• Prefer to wear for all encounters	5
Suggestions for risk-tailored approach	
• Targeted education for patients and visitors	7
• Targeted education for staff	4
• Signage	3

N=24

Table 3. Changes in Hand Hygiene and Personal Protective Equipment (PPE) Donning Compliance During Intervention Versus Baseline and Estimated Effect of the PPE-Free Zone

Model	Relative Risk	95% Confidence Interval	P Value
Hand hygiene compliance (N= 2,335)			
Control units ^a	0.70	(0.55–0.90)	.005
Intervention units ^a	0.92	(0.79–1.07)	.29
Interaction term (effect of PPE-free zone) ^b	...	...	.07
PPE donning compliance (N= 2,952)			
Control units ^a	1.00	(0.83–1.20)	.97
Intervention units ^a	1.17	(1.04–1.32)	.009
Interaction term (effect of PPE-free zone) ^b	...	...	.15

...but the effectiveness of the impact remains uncertain.

O'Hara LM, et al. Infect Control Hosp Epi 2024; online 4/22/24.

Visnovsky LD, et al. Infect Control Hosp Epi 2019;40:761

Recommended further reading with expanded references

JOURNAL ARTICLE

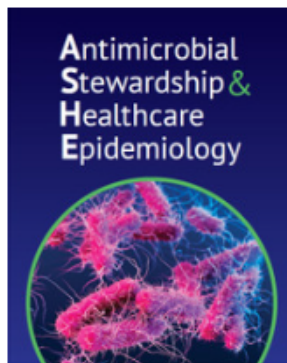
EDITOR'S CHOICE

Are Contact Precautions “Essential” for the Prevention of Healthcare-associated Methicillin-Resistant *Staphylococcus aureus*? FREE

Daniel J Diekema ✉, Priya Nori, Michael P Stevens, Matthew W Smith, K C Coffey, Daniel J Morgan [Author Notes](#)

Clinical Infectious Diseases, Volume 78, Issue 5, 15 May 2024, Pages 1289–1294,
<https://doi.org/10.1093/cid/ciad571>

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Infection Prevention & Control

Contact precautions for the control of endemic pathogens: Finding the middle path

Published online by Cambridge University Press: **24 March 2023**

Gonzalo M. Bearman , Anthony D. Harris and Evelina Tacconelli

Article

Figures

Metrics

Questions