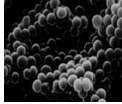


MRSA in Healthcare Facilities, The Growing Burden

Dr. Susan Huang, University of California School of Medicine

A Webber Training Teleclass

MRSA in Healthcare Facilities The Growing Burden



Susan S. Huang, MD MPH
Assistant Professor and Hospital Epidemiologist
University of California Irvine School of Medicine

Hosted by Paul Webber
paul@webbertraining.com

www.webbertraining.com

The Need for MRSA Assessment

- The scope of the problem in healthcare
- The impact of MRSA carriage
- The changing reservoir
- Options for response

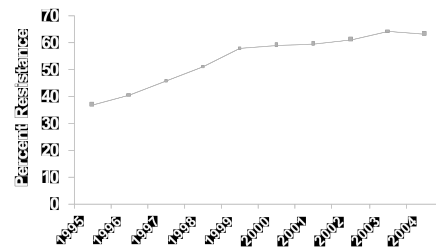
Staphylococcus aureus

- 30% of people carry *S. aureus*
- Methicillin resistant form (MRSA)
 - First noted in US in 1968
 - Rapid increase since 1980s
 - Traditionally acquired in hospital settings
 - Resistant to common antibiotics
 - Source of outbreaks, infections
- Community-associated strains

Healthcare Associated MRSA

The Hospital

**Methicillin (oxacillin)-resistant
Staphylococcus aureus (MRSA) Among ICU
Patients, 1995-2004**

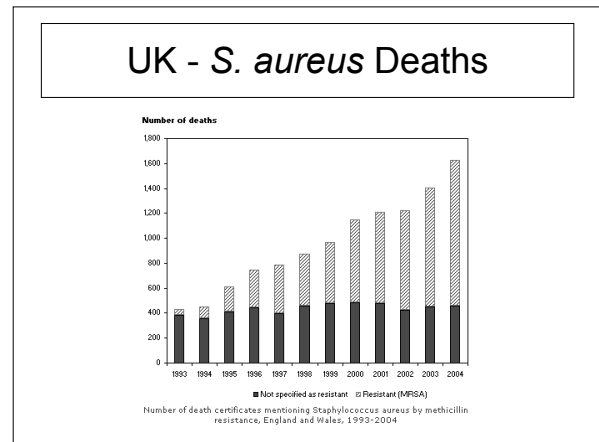
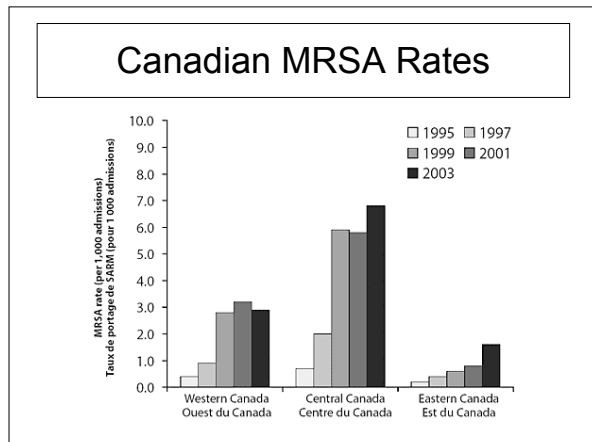


Source: National Nosocomial Infections Surveillance (NNIS) System

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US Burden Estimates

2000	2005
• 133,500 hospitalizations	• 278,200 hospitalizations
• 33,250 septic events	• 56,250 septic events
• 29,000 pneumonias	• 36,500 pneumonias
• 71,000 other infections	• 185,500 other infections

Klein et al. Emerg Infect Dis 2007;13(12):1840-6

What happens to you
if you acquire
MRSA?

Post-Acquisition Studies

Among new carriers, how many develop infection?

All inpatients:
11-20%^{1,2}

ICU patients:
38% develop bacteremia³

1 Pujol et al. Eur J Clin Microbiol Infect Dis 1994; 31(1):96-102
2 Coello et al. J Hosp Infect 1997;37:39-46
3 Pujol et al. Am J Med 1996; 100(5):509-16

MRSA Sequelae

- Among tertiary care patients, there is a substantial risk of later infection
 - 29% develop infection in next 18 months
 - 28% of infections involve bacteremia
 - 49% of all infections occur post-discharge

Huang SS and Platt R. Clin Infect Dis 2003;36:281-5

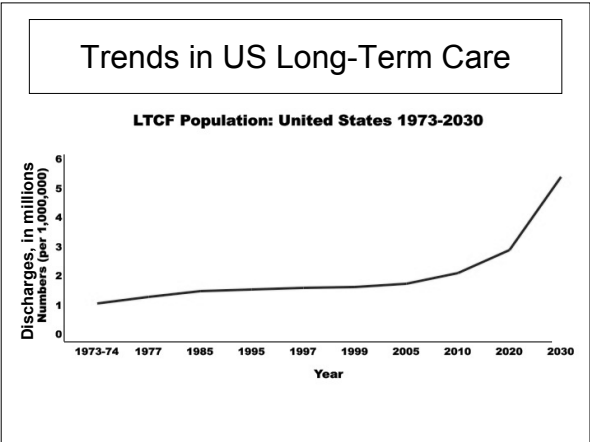
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The Nursing Home

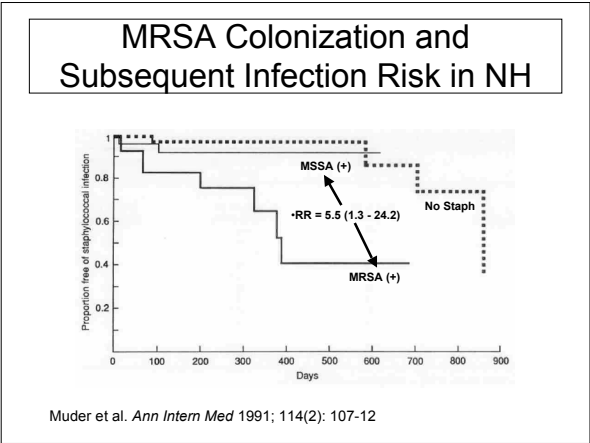
Nursing home slides are attributed to C. Crnich, MD at U Wisconsin



Risk of MRSA Infections in NH

- Michigan VA Nursing Home, 1989-90
- 341 patients, screened on admit and monthly
- Carriage
 - 20% of patients imported MRSA on admission
 - 14% of MRSA-negative patients acquired MRSA
 - Overall MRSA prevalence = 23%
- Infection
 - 9 infections, 4 requiring re-hospitalization
 - 11% risk of infection among carriers

Bradley et al. *Ann Intern Med* 1991; 115(6): 417-22

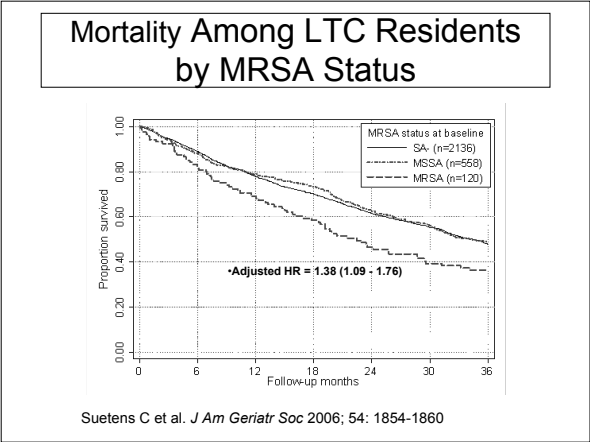


Re-Hospitalization Rates Among MRSA+ and MRSA- NH Residents

- 3 year prospective cohort study 2000-2003
- 23 Belgian nursing homes
- 2,814 patients

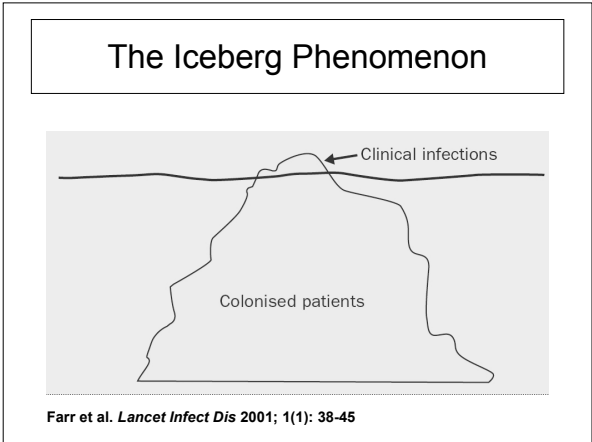
Reason	N	INCIDENCE RATE		HAZARD RATIO IRR (95% CI)	P-value
		MRSA(+)	MRSA(-)		
Cardiopulmonary	267	6.0	4.9	1.2 (0.7 - 2.22)	0.49
Infection	273	7.5	4.9	1.6 (0.9 - 2.6)	0.09
RTI	121	4.5	2.1	2.1 (1.1 - 4.1)	0.03
UTI	45	1.0	0.8	1.2 (0.3 - 5.0)	0.79
Other	87	2.0	1.6	1.3 (0.5 - 3.4)	0.65
Other causes	505	11.0	9.3	1.2 (0.7 - 1.8)	0.36
Any admission	1,904	36.0	35.1	1.0 (0.8 - 1.3)	0.89

Suetens C et al. *J Am Geriatr Soc* 2006; 54: 1854-1860



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How common is MRSA?
Should we screen?



The Hospital

- The Hidden Reservoir**
- Active Surveillance
 - Increases detection 30-50%
 - Recommended for high risk areas in 2003 SHEA Guidelines
- Lucet et al. *Arch Intern Med* 2003;163:181-8
 Huang et al. *J Infect Dis* 2007;195(3):330-8.

- CDC Prevention Epicenters**
- 12 ICUs
 - Admission and weekly nares cultures
 - 1-year study period
 - Measures with and without surveillance cultures
- Huang et al. *J Infect Dis* 2007;195(3):330-8.

Enhanced Detection of MRSA Reservoirs in ICUs

	Estimate	% Increase w Screen
Importation	12%	50% (30-135%)
Acquisition	3.4%	31% (7-157%)
Prevalence	18%	31% (19-63%)

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Enhanced Detection

House-wide prevalence

- 2.7% MRSA+ - Emory University Hospital¹ '98
- 7.3% MRSA+ - Grady Memorial Hospital² '03
- 6.3% MRSA+ - Evanston Northwestern Healthcare³ '05

¹ Jernigan et al. ICHE 2003;24:409-14
² Hidron et al. CID 2005;41:159-66
³ Robicsek et al. Ann Int Med 2008;148:409-18

Value of Active Surveillance

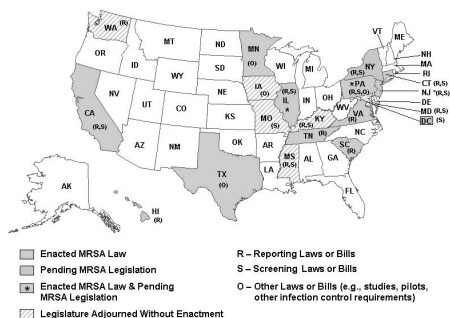
- Knowledge of iceberg
 - Increases detection
 - Increases awareness
 - Corrects misclassification
- Rapid isolation
 - Contact precautions
 - Prevents transmission

National Measures

National Trends

- Institute of Healthcare Improvement
 - 5,000 Lives Campaign
- VA Medical Centers
 - Mandatory MRSA surveillance
- CDC
 - NHSN begin screening for MRSA in one unit

MRSA Legislation



State MRSA Legislation

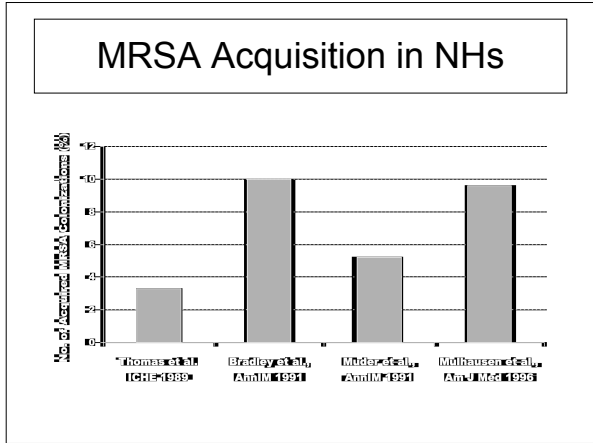
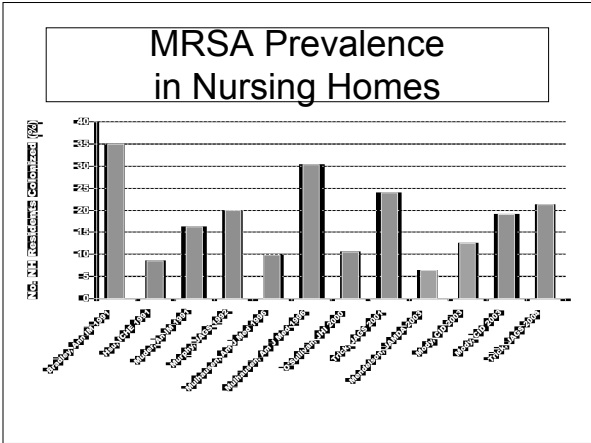
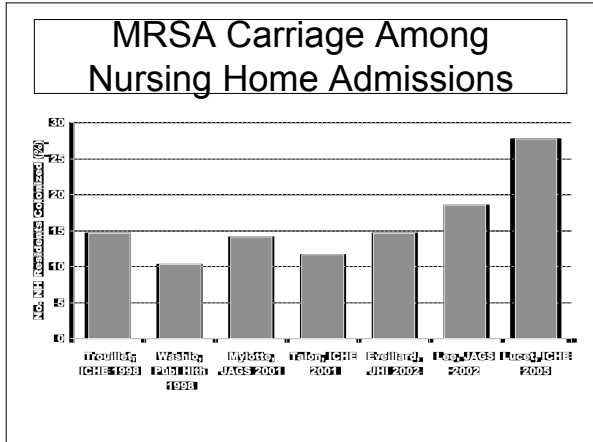
- Minnesota (May 07)
 - Mandatory MRSA program
- Tennessee (May 07)
 - Mandatory MRSA reporting to DPH
- Texas (June 07)
 - Mandatory MRSA reporting to DPH and public
- Pennsylvania (July 07), Illinois (Aug 07)
 - Active surveillance in acute /subacute hospitals if high risk
 - Public reporting of MRSA HAI rates
- New Jersey (Aug 07)
 - Mandatory active surveillance in all ICUs, flagging, isolation, compliance, reporting to state
- California (Sept 08)
 - Active surveillance among ICU and high risk patients

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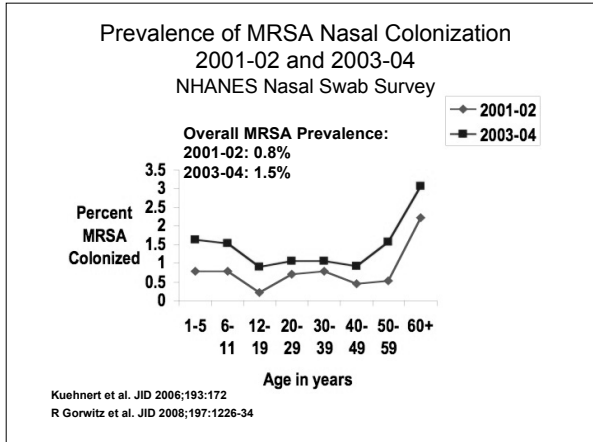
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The Nursing Home

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The Changing MRSA Reservoir

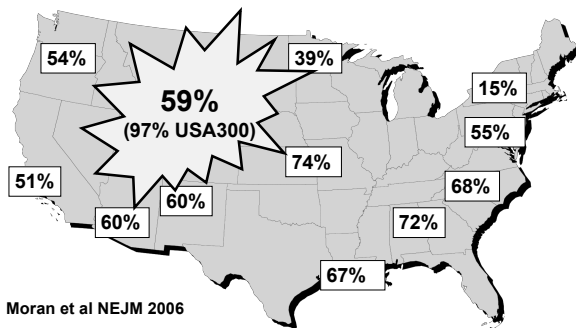


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MRSA Was the Most Commonly Identified Cause of Purulent SSTIs Among Adult ED Patients (EMERGENCY ID Net), August 2004



Community vs Hospital MRSA

- | CA-MRSA | HA-MRSA |
|------------------------|------------------------|
| • No risk factors | • Risk factors |
| • USA 300, 400 | • USA 100, 200 |
| • Antibiotic sensitive | • Antibiotic resistant |
| • PVL Toxin | • No PVL Toxin |
| • Skin & Soft Tissue | • Pna > Soft Tissue |
| • Necrotizing | • Non-Necrotizing |

Antibiotic Profiles Merging

Antibiotic	CA-MRSA % Susceptible	HA-MRSA % Susceptible
β -lactams	0%	0%
clindamycin	85%	30%
levofloxacin	20-80%	10%
Bactrim	85-99%	85%
doxycycline	65-90%	90%
rifampin	70-100%	95%

THE NEW ENGLAND JOURNAL OF MEDICINE

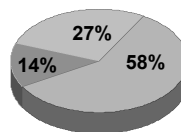
ORIGINAL ARTICLE

Necrotizing Fasciitis Caused by Community-Associated Methicillin-Resistant *Staphylococcus aureus* in Los Angeles

Loren G. Miller, M.D., M.P.H., Francoise Perdreau-Remington, Ph.D.,
 Gunter Rieg, M.D., Sheherbano Mehdi, M.D., Josh Perleth, M.D.,
 Arnold S. Bayer, M.D., Angela W. Tang, M.D., Tieu O. Phung, M.D.,
 and Brad Spellberg, M.D.

Miller et al. NEJM 2005;352:1445-53.

Invasive MRSA Cases CDC ABCs 2004-2005



- Community-Associated
- Healthcare-Associated (community-onset)
- Healthcare-Associated (hospital-onset)

Klevens M et al. JAMA 2007;298(15):1763-71

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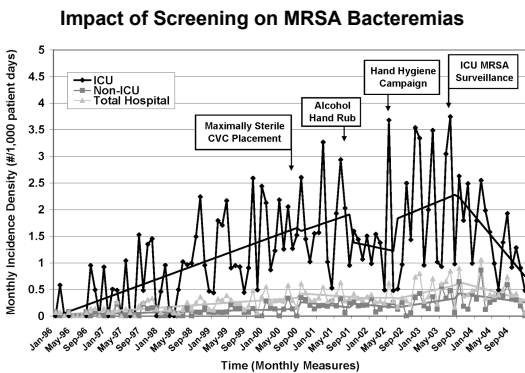
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USA 300 In Nursing Homes

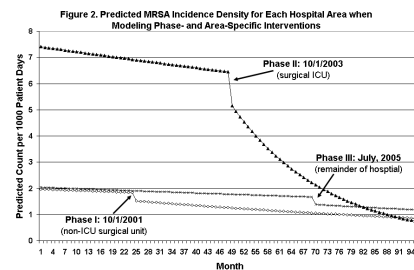
- Raab et al., *Infect Control Hosp Epidemiol* 2006; 27: 208-211
 - 15/197 (7.6%) colonized with PVL(+) MRSA
 - PVL(+) > PVL(-) MRSA isolates
- Mody et al. 44th Annual IDSA Meeting
 - 7/213 (3.3%) colonized with MRSA containing the SCCmec IV

Response

Screen and Isolate



Phased In Screening & Isolation Impact on MRSA Acquisition



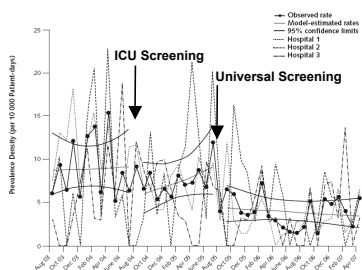
VA Pittsburgh Medical Center
Ellingson et al. SHEA 2008

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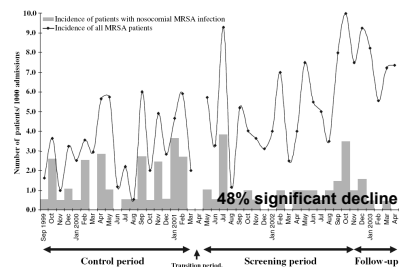
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Housewide Screening & Isolation Impact on MRSA Infections



Evanston Northwestern Health Care
Robicsek et al. Ann Int Med 2008;148:409-18

High Risk Screening & Isolation Impact on MRSA Infection



Klinikum im Fredrichshain, Berlin Germany
Wernitz et al. Clin Microbiol Infect 2005;11:457-65

Decolonize

Persistence of MRSA

- MRSA is carried for a long time
- Median carriage among inpatients is 6-40mo¹⁻³
- Strain typing studies have shown 40-50% patients serially carry multiple strains^{1,4,5}
- Repeat MRSA infection is often due to the same strain⁶

¹ Sanford et al. CID 1994;19(6):1123-8 ² Scanvic et al. CID 2001;32(10):1393-8
³ Huang et al. JID 2007;195(3):330-8 ⁴ Herwaldt et al. ICHE 2002
⁵ Maslow et al. Eur J Clin Micro ID 1995 ⁶ Huang et al. CID 2008;46:1241-7/

What Regimen?

- Mupirocin
- Chlorhexidine bathing
- Mupirocin + Chlorhexidine
- Systemic agents
 - Bactrim, doxycycline, rifampin

Mupirocin

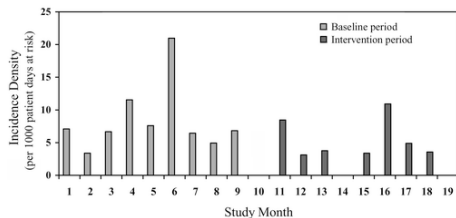
- VA Nursing Home in Michigan
- 38% *S. aureus* carriage (N=39)
 - 54% MRSA
 - 46% MSSA
- Mupirocin for 7d eradicated 91%
- At two months, 56% remained persistently clear

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Mupirocin + Chlorhexidine

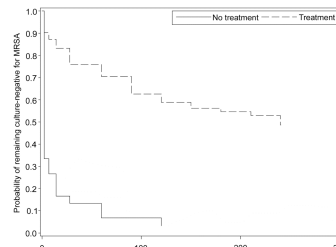
- 52% Decrease in MRSA incidence Density



Ridenour et al. ICHE 2007;28(10):1155-61

Topical + Oral + Bathing

- 74% remained negative at 3 months



Simor et al. CID 2007;44(2):178-85

Common Regimen

- Intranasal mupirocin bid x 5-7d
- Chlorhexidine baths x 5-7d
- Serial screening
 - nares
 - prior colonized sites

Vaccinate

Vaccine Trial

- *S. aureus* conjugate vaccine
- Tested on patients on hemodialysis
- Provided partial immunity
 - Initially thought to be 40 weeks
 - Difficult to verify with serial inoculations
- No imminent candidates

Shinefield H et al. *New Engl J Med* 2002; 346:491-96

Disinfect

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Environmental Contamination

- Widespread contamination in room
 - Door knobs
 - Bed rails
 - Counters/tables
 - Phone
 - Monitors
 - Window ledges
- 58% of ICU acquisition had the same strain type as another patient actively or very recently in the ICU

Boyce et al. ICHE 1997;18(9):622-7
 Rampling et al. J Hosp Infect 2001;49(2):109-16
 Oie et al. J Hosp Infect 2002; 51(2):140-3
 French et al. J Hosp Infect 2004;57(1):31-7

Sexton et al. J Hosp Infect 2006;62(2):187-94
 Hardy et al. ICHE 2006;27(2):127-32.
 Huang et al. Arch Int Med 2006;166(18):1945-51

Environmental Contamination

- Similar whether colonized or infected
- Shelley et al. (SHEA 2008)
 - Contamination of room sites (bed rail, table, call button, phone) was similar among colonized patients (47%) vs infected patients (45%)
 - Similar contamination of providers' hands after examination
 - 90% of environmental strains were same as nares

Common Cleaning Issues

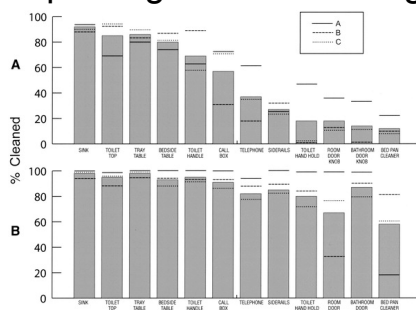
- National Standards
 - 10 minutes wet contact time
 - Visual inspection
- Application of disinfectant
- Time pressures
- Uncertain ownership of items

Black Light Marker

- Fluorescent marker
 - An invisible gel that glows under blacklight
 - Applied to surfaces in over 40 US hospitals
 - An inert, safe, and unreactive substance



Improving Room Cleaning



•Carling PC. Clin Infect Dis 2006;42(3):385

Back to Basics

TABLE 1
EFFECTIVENESS OF DISINFECTION

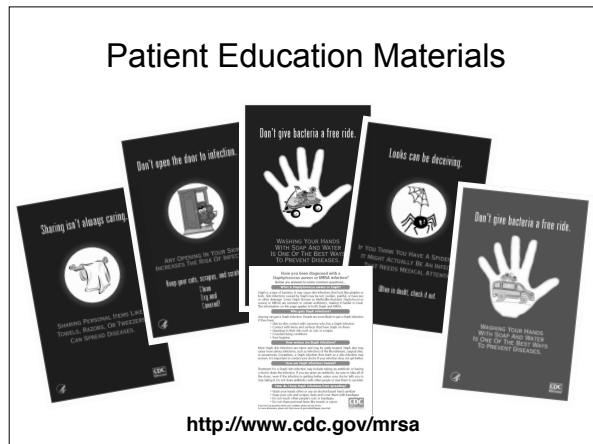
	No. of Colonized Sites (%)	
	Conventional Disinfection	Bucket Method
First disinfection	60/376 (15.9)	0/135
Second disinfection	8/82 (9.8)	
Third disinfection	3/28 (10.7)	
Fourth disinfection	0/10 (0)	

Byers et al. ICHE 1998; 19:261-4

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Educate



- ### MRSA Conclusions
- Endemic in hospitals, nursing homes, communities
 - Morbidity and mortality is high among inpatients
 - Community and healthcare reservoirs are merging and expanding
 - Legislation and public reporting have arrived
 - There are several options for response

