

# Relative Impact of Hand Hygiene on Healthcare-Associated Infections

Dr. Elaine Larson, Columbia University


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Slide 1

**Relative Impact of Hand Hygiene on Healthcare-Associated Infections**  
*What's left if hand hygiene is perfect?*  
**Dr. Elaine Larson**  
Columbia University School of Nursing

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Slide 2

**Review of Studies: Criteria**

- Conducted between 1960-2003
- Prospective (not outbreak investigations or retrospective)
- In an acute care setting
- English language
- Intervention: hand hygiene
- Outcome: healthcare-associated infection

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Slide 3

**Early Work: 1960s**

- 92% (45/49) of neonates handled by nurses with unwashed hands versus 53% (17/32) handled with washed hands acquired the caretaker's *S. aureus* strain ( $p < 0.001$ )
- Reduction of about 1/3



(Wolinsky, Lancet 1960, Sept 17: 620.  
Mortimer, Am J Dis Child 1962; 104:289)

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**Early studies (1970-90) in Adult ICUs**

- 1977 Reduced **Klebsiella** infections (Casewell, Br Med J, 2:1315)
- 1982 Reduced infections (Maki, J Chemother 1989;1(suppl 1):3)
- 1984 Reduced infections (Massanari, Am J Infect Control;12:247)



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Slide 5

**Combined Intervention**

- Handwashing AND cohorting
- 1986-7: 34.8% of children with congenital heart disease got RSV
- 1987-8: 3.3% (Isaacs, Arch Dis Child 1991; 66:227)



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Slide 6

**ICU Studies in 1990s**

- 1990, No impact (Simmons, Infect Control Hosp Epidemiol,11:589)
- 1992, Difference in infection rates between two difference regimens (Doebelling, N Engl J Med, 327:88)
- 1994, Eliminate MRSA (with other interventions) (Webster, J Paediatr Child Health, 30:59)
- 1995, Eliminate MRSA (with other interventions) (Zafar, Am J Infect Control;23:200)

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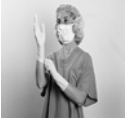
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**Descriptive Evidence**

- Case-control study of outbreak of SSI
- Multiple risk factors studied
- Only significant correlate was use of plain vs. antiseptic product for hand scrubbing ( $p < 0.0001$ )

Grinbaum, ICHE 1995;16:198



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Slide 8

**Hospital-Wide Intervention**



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Slide 9

<b>Intervention</b>	<b>Comparison</b>
<i>Feb-June and Sept-Dec 98 (8 months)</i>	
• 477,680 handwashes recorded	• 382,887 handwashes recorded



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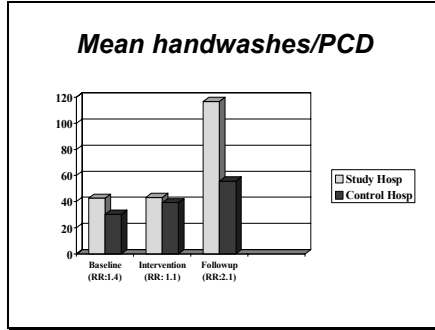
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Slide 11

Intervention	Comparison
<ul style="list-style-type: none"><li>• 109,732 patient days monitored</li><li>• 29 VRE, 54 MRSA infections</li></ul>	<ul style="list-style-type: none"><li>• 236,989 patient days monitored</li><li>• 80 VRE, 55 MRSA infections</li></ul>



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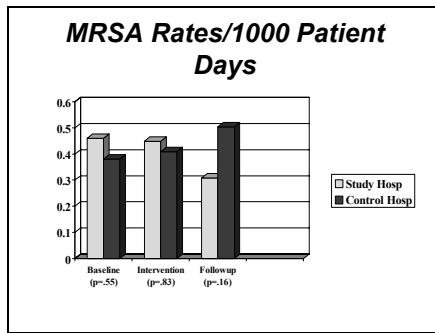
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Slide 12



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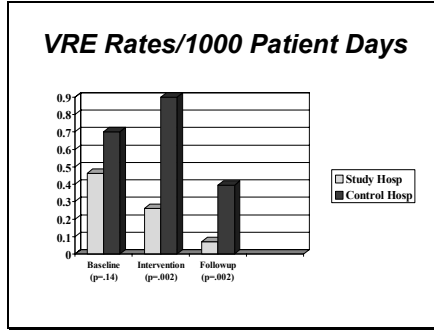
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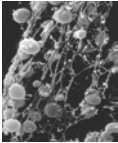
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Slide 14

**Change from Baseline to Followup Periods: MRSA**

- Intervention Hospital: 33% decrease
- Comparison Hospital: 31% increase
- $p < 0.0001$



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Slide 15

**Change from Baseline to Followup Periods: VRE**

- Intervention Hospital: 85% decrease
- Control Hospital: 44% decrease  $p < 0.0001$



Larson, et. al. Behav Med 2000; 26:14

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## *Other Studies This Decade*

- 2000, MICU/NICU, Reduction in VRE, no change in MRSA (Pittet, Lancet;356:1307)
- 2001, Hospital-wide, Reduction in IV complications after hand disinfection, but not after regular handwashing (Hirschmann, J Hosp Infec, 49:199)

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Slide 17

## *In an orthopedic surgical unit..*

Over 10 month period, infection rates were reduced by 36.1% after introduction of an alcohol-based hand rinse



Hilburn, et al. AJIC 2003; 31:109

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Slide 18

## *Alcohol sanitizer in longterm care*

- Infection data collected in a 275-bed extended care facility for 34 months
- 30.4% decrease in infection rates on two units using sanitizer



Fendler, et al. AJIC 2002; 30:226-3

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**Randomized Clinical Trial**

- Gown and glove isolation vs. strict handwashing in children with solid organ transplantation
- Both interventions resulted in significant reduction in infections ( $p=0.008$ )



(Slota, Crit Care Med 2001; 29:405)

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Slide 20

**Alcohol Vs. Traditional Scrub:  
30-Day SSI Rates**

- Clean and clean-contaminated surgery
- Protocols: 75% propanol, 4% PI, 4% CHG
- Infection rates: 2.44% (55/2252) in alc group; 2.48% (53/2135) in other groups
- Compliance significantly better with alcohol ( $p=0.008$ ), and hands were less dry with less skin irritation

Parienti, JAMA 2002; 288:722-7

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Slide 21

**What's Needed Is a Health  
Impact Assessment**

- Health impact assessment helps to determine how hand hygiene will affect people's health. Recommendations to improve are produced.
- It is a practical way to influence decision makers.
- People use it to assess policies, programs and projects.

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**One component...**

- Identify and consider range of evidence for potential impacts on health and equity
  - Collect and collate best available evidence
  - Consider evidence and appraise impact



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Slide 23

**What Evidence Is Available?**

- Plenty from developing countries, in day care centers and other community settings, but may not be applicable to hospitals
- Cannot study this issue in hospitals for ethical reasons. Hence, mathematical modeling is a promising approach

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Slide 24

**Quantitative assessment of risk reduction from hand washing with antibacterial soap after exposure to enteric pathogen**

“Adequate washing of hands after diapering reduces risk and can be further reduced by a factor of 20% by the use of an antibacterial soap”



Gibson, et al. Symp Ser Soc Appl Microbiol. 2002;(31):136S-143S

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## ***Mathematical Models for Transmission Dynamics***

- Simulation of three control measures: effective handwashing, antimicrobial policy, curtailing admission of colonized patients
- “Effective handwashing compliance reduced staff colonization, but had only limited effect on patient colonization unless colonized admissions were curtailed

Sebille, *Infec Contr Hosp Epidemiol* 1997; 18:84

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Slide 26

## ***VRE in ICU***

- Impact of infection control was to reduce prevalence from predicted 79% to observed 36%
- Most powerful measures: handwashing and staff cohorting
- “Compliance for handwashing significantly in excess of reported levels, or cohorting of nursing staff, are needed to prevent nosocomial transmission of VRE in endemic settings”

Austin, *Proc Natl Acad Sci* 1999; 96:6908

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Slide 27

## ***Stochastic model for S. aureus spread on medical-surgical ward***

- Modeled introduction rate, prevalence, colonized patient days
- Small increases in frequency of effective hand washing were sufficient to control endemic organisms

Cooper, *J Hosp Infec* 1999;43:131



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***In all models, however,***

- Slight changes in assumptions or parameters have a major impact on findings.
- Unpredictable and chance events are "amongst the most important factors in determining the course of an outbreak"  
(Cooper)



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Slide 29

***Summarizing results***

- Isaacs study, ~90% reduction in RSV with handwashing AND cohorting
- Austin model, ~50% reduction in VRE transmission with handwashing AND cohorting
- Larson study, ~30% reduction in VRE and MRSA with handwashing
- Hilburn, 36% reduction with alcohol
- Fendler, 30% reduction with alcohol

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Slide 30

***Hence***

- Results from clinical studies and mathematical modeling are consistent—potentially an approximately one-third reduction in infections with ideal (or at least improved) hand hygiene



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***So, what if hand hygiene is perfect?***

- Mean (SD) attributable costs of nosocomial infections:
  - General: \$13,900 (\$18,000)
  - Surgical: \$15,600 (\$13,800)
  - Bloodstream: \$38,700 (\$3,100)
  - Urinary: ?
  - MRSA \$35,300 (\$2,900)

Stone, AJIC 2002; 30:145

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Slide 32

***IF....***

- About 30% of healthcare-associated infections are preventable (SENIC)

**AND**

- Hand hygiene reduces the risk by about 30%

**THEN**

- About 9% of current infections could be prevented by hand hygiene alone (conservative estimate)

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Slide 33

***There's still much to do and many options to try***

- Improving host defenses
- Other barrier practices and products

**But....**

a 9% reduction in infections JUST with hand hygiene would be a major patient safety coup—a brilliant and notable success!

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