Relative Impact of Hand Hygiene on Healthcare-Associated Infections
Dr. Elaine Larson, Columbia University
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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

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

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

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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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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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ICU Studies in 1990s
- 1990, No impact (Simmons, Infect Control Hosp Epidemiol, 11:589)
- 1992, Difference in infection rates between two difference regimens (Debelius, N Eng J Med, 327:38)
- 1994, Eliminate MRSA (with other interventions) (Webster, J Pediatr Child Health, 30:93)
- 1995, Eliminate MRSA (with other interventions) (Zafar, Am J Infect Control;23:280)

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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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Hospital-Wide Intervention

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Intervention  Comparison
Feb-June and Sept-Dec 98 (8 months)

- 477,680 handwashes recorded
- 382,887 handwashes recorded

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Mean handwashes/PCD

- Study Hosp (Baseline)
- Study Hosp (Intervention)
- Study Hosp (Followup)
- Control Hosp

- Baseline (RR:1.4)
- Intervention (RR: 1.1)
- Followup (RR:2.1)

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Intervention
- 109,732 patient days monitored
- 29 VRE, 54 MRSA infections

Comparison
- 236,989 patient days monitored
- 80 VRE, 55 MRSA infections

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MRSA Rates/1000 Patient Days

- Study Hosp
- Control Hosp

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VRE Rates/1000 Patient Days

Baseline (p=.14)  
Intervention (p=.002)  
Followup (p=.002)  
Study Hosp  
Control Hosp

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Change from Baseline to Followup Periods: MRSA

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

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Change from Baseline to Followup Periods: VRE

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


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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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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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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


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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)

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

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

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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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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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”


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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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**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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**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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*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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*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: $35,300 ($2,900)

Stone, AJIC 2002; 30:145

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)

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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