Hand Hygiene - Science or Fiction?

William Clayton Petty MD
Which President of the United States died in office because someone did not wash their hands?
President Garfield Shot 2 July 1881

- Dr. Bliss probed wound with finger at site
- Later 16 other doctors probed wound with unsterilized metal probes or with their fingers
- Wound was initially three-inches deep.
- At death, wound was 20 inches long and oozing pus
- Lingered 80 days.
- Lost 80 pounds.

President James A. Garfield
Shot only 4 months after inauguration
Before Contact
“I dismount from my animal, wash my hands, go forth to my patients.”

After Contact
“Never forget to wash your hands after having touched a sick person.”

1199 - Maimonides
644 Years Later in 1843

- Published essay on “Puerperal Fever, as a Private Pestilence”
- Childbed fever transmitted from patient to patient by none other than doctors and nurses attending them.
- Letter from prominent Obstetrician: “Doctors are gentlemen, and gentlemen’s hands are clean”

Oliver Wendell Holmes MD
Harvard Professor of Anatomy
Hand Washing Standards 1847

- Colleague cut finger during an autopsy
- Autopsy showed signs of childbed fever
- Noted medical students went from autopsy room to OB without washing their hands before doing vaginal exams
- Postulated medical students were carrying “cadaverous particles” to the mothers

Dr. Ignaz Semmelweis
Vienna
What Dr. Semmelweis Observed

• First Obstetrical Clinic:
  • Babies delivered by medical students
  • 13.1% mortality

• Second Obstetrical Clinic:
  • Babies delivered by midwives
  • 2.03% mortality
Ordered medical students to wash hands with 4% chlorinated lime until “slimey”
Results of Hand Hygiene

- First Month: Mortality fell from 13.1% to 2.38% in Medical Student Clinic
- Peers ignored him, mocked him and openly ridiculed him
- Moved to Budapest
- With full authority over the Obstetrical ward the mortality fell to 0.82%
- Considered the “Savior of Mothers”
Bacteria Discovered
17 Sept 1683-Letter to Philosophical Royal Society:
“... great company of living animalcules, a-swimming ... In such enormous numbers, that all the water ... seemed to be alive.”

Antony van Leeuwenhoek 1632-1723
1879

- Found *Streptococcal* bacteria in the blood of women with childbed fever
- Once said of doctors: “The thing that kills women with childbirth fever...is you doctors that carry deadly microbes from sick women to healthy women”

**Louis Pasteur**

Regarded as one of the Fathers of Germ Theory and Bacteriology
- 1931 - Invention of Electron Microscope
- 1955 - Discovery of Virus DNA structure
- 1955 - Discovery of Virus replication process
Hand Print of Bacteria

Myth Buster

“Doctors are gentlemen, and gentlemen’s hands are clean”
Normal bacteria counts range from:
$5 \times 10^3$ to $5 \times 10^6$ units/cm²

Microorganisms persist for a long time on skin

Bacteria on Hands
Hand Hygiene
(HH)

A - Bacterial growth - NO Hand Hygiene

B - Bacterial growth - After soap & water

C - Bacterial growth - After Alcohol use

Agar Plate
Hand Contamination of Anesthesia Providers is an Important Risk Factor for Intraoperative Bacterial Transmission

2011 - 164 episodes with anesthesia providers studied*

- 12% Intraoperative bacterial transmission to anesthesia machine by anesthesia provider
- 47% Bacterial transmission to stopcock by anesthesia provider

**Bacteria on Hands:**
- MRSA - 12/164
- Other Staph - 164/164
- Corynobacterium - 14/164
- Streptococcus - 128/164
- Gram negative - 81/164

* Dartmouth-Hitchcock Medical Center, New Hampshire
Hospital Acquired Infections (HAIs)

- **Rate:**
  - > 2,000,000 per year
  - 100,000 deaths

- **Costs and actions:**
  - $45,000,000,000 per year
  - 1993 - 11 HCWs contracted Hepatitis A from same patient. Why? They did not wash their hands!
  - 2005 - Pennsylvania reported 11,588 HAIs, estimated cost: > $2 billion
  - 2004 - HAIs listed in top 10 malpractice lawsuits
    - Patient has the best chance to win a HAI malpractice case (45%)
  - 2006 - Deficit Reduction Act - Medicare will not pay for certain negligent acts
  - 2006-2011: 27 States began publishing HAI infection rates
ADHERENCE

How are we doing?

If you could see the germs, you would wash your hands.
“We still fail to give germs the respect they deserve”

- 2011 - Academic Center reports only 2% HH upon entering OR and 8% before patient contact
- 2009 - 12-month Multicenter Collaboration studying HH:
  - 26% HH compliance in ICUs
  - 36% HH compliance in non-ICUs
- 1981-2000 - 34 studies examined HH compliance
  - Average HH compliance: 46% (range 5%-81%)
Better Statistics for Self-Preservation

- 95% of HH before working on HIV or Hepatitis patients. Fell to 58% with other patients.
- 17% of anesthesia providers preformed HH before patient care but increased to 69% before a meal.
- 996 HCWs studied in Denmark:
  - 63% HH compliance before patient care
  - 69% HH compliance after patient care
Deterrents’ to Hand Hygiene
Extensive Research
on Deterrents to Hand Hygiene
- Most Quoted -

• Production pressure: i.e. Turnover time in OR
• Ineffective placement of dispensers or sinks
• HH compliance data are not collected or reported accurately or frequently
• Lack of accountability
• Safety culture does not stress HH at all levels, including support of administration
• Ineffective or insufficient education
• Perception that HH is not needed if wearing gloves
• Health care workers forget
• Distractions
### Extensive Research on Deterrents to Hand Hygiene - Others Quoted -

- Skin irritation by HH agents
- High workload and understaffing
- HH interferes with HCW-patient relationship
- No role model from colleagues or superiors
- Skepticism
- Disagreement with the recommendations
- Hands full
- Lack of awareness of definitive impact of improved HH on nosocomial infection rates
- Nurses better than doctors at HH compliance
- Females better than males at HH compliance
Is The Hospital Too Clean?

Direct observation of hand washing with soap and water after a toilet visit

- European Congress Of Microbiology & Infectious Diseases
- 45 Convention Center Toilets
- Highway Toilets
- 162
- Healthcare Workers
- 416 Hospital Toilets
### Results

<table>
<thead>
<tr>
<th>Category</th>
<th>Value</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>European Congress Of Microbiology &amp; Infectious Diseases</td>
<td>38/45</td>
<td>84%</td>
</tr>
<tr>
<td>Highway Toilets</td>
<td>121/162</td>
<td>75%</td>
</tr>
<tr>
<td>Healthcare Workers</td>
<td>190/416</td>
<td>46%</td>
</tr>
</tbody>
</table>

Relatively clean and safe feeling of the hospital environment may block the trigger for hand hygiene

*All Males
Recommendations/Guidelines for Hand Hygiene
(All basically the same)

- World Health Organization
- Center for Disease Control
- Department of Veterans Affairs
- Healthcare Infection Control Practices Advisory Committee
- Professional Societies
Recommendations/Guidelines

All expressed over and over:

*Hand Hygiene is the most important factor in the prevention of health care-acquired infections*
CDC Recommendations/Guidelines
44 in 8 Categories

1. Indications for hand washing and hand antisepsis (14)
2. Hand hygiene technique (4)
3. Surgical hand antisepsis (5)
4. Selections of hand hygiene agents (5)
5. Skin care (2)
6. Other aspects of hand hygiene (6)
7. HCWs educational and motivational programs (3)
8. Administrative measures (5)

Total Length: 1350 words in the 45 page document
When/Where to Perform Hand Hygiene

Your 5 Moments for Hand Hygiene - WHO

1. Before touching a patient
2. Before a procedure
3. After a procedure or body fluid exposure risk
4. After touching a patient
5. After touching a patient’s surroundings
Hand Hygiene Summary

Why
When
What to use
• How to use it
• How long to wash
## Why Alcohol is Best

<table>
<thead>
<tr>
<th>Antiseptics</th>
<th>Gram + Bacteria</th>
<th>Gram - Bacteria</th>
<th>Enveloped Virus</th>
<th>Non-enveloped Virus</th>
<th>Myco-Bacteria</th>
<th>Fungi</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohols</td>
<td>***</td>
<td>***</td>
<td>***</td>
<td>**</td>
<td>***</td>
<td>***</td>
</tr>
<tr>
<td>Chloroxylenol</td>
<td>***</td>
<td>*</td>
<td>*</td>
<td>±</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Chlorhexidine</td>
<td>***</td>
<td>**</td>
<td>**</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Hexachlorophene</td>
<td>***</td>
<td>*</td>
<td>?</td>
<td>?</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Iodophors</td>
<td>***</td>
<td>***</td>
<td>**</td>
<td>**</td>
<td>**</td>
<td>**</td>
</tr>
<tr>
<td>Triclosan</td>
<td>***</td>
<td>**</td>
<td>?</td>
<td>?</td>
<td>±</td>
<td>±</td>
</tr>
<tr>
<td>Quaternary Ammoniums</td>
<td>**</td>
<td>*</td>
<td>*</td>
<td>?</td>
<td>±</td>
<td>±</td>
</tr>
</tbody>
</table>
Why Alcohol is Preferred

- Optimal antimicrobial spectrum
- Fast acting
- Better than soap and water
- No wash basin or sink necessary
- Can have dispenser on wall, in pocket, or on belt
Fast Acting is Important

• Average duration of hand washing with soap/water by HWCs:
  1989 - 24 seconds
  1997 - 4.7-5.2 seconds

• CDC and WHO Recommendations:
  40-60 seconds with soap/water
  20-30 seconds with alcohol
Multiple Kinds of Dispensers
Strategies to Improve Hand Hygiene Compliance

Studies have shown that at least 33% of all HAIs could be prevented if healthcare workers complied with recommended guidelines.
WHO Guidelines on Hand Hygiene in Health Care

First Global Patient Safety Challenge
Clean Care Is Safer Care
How-to Guide: Improving Hand Hygiene

A Guide for Improving Practices among Health Care Workers
Joint Commission
Center for Transforming Healthcare
Targeted Solutions Tool™ Hand Hygiene Project

• Guide to a step-by-step process to
  • 1. Accurately measure HH compliance
  • 2. Identify barriers to excellent performance
  • 3. Provide proven solutions to address barriers

• Launched Sept 2010 and by March 2011:
  • 1. 1,563 hand hygiene projects in progress
  • 2. 106,000 HH observations in the database
  • 3. Organizations using Tool™ have increased HH compliance by 44%
Measuring Hand Hygiene Adherence
Overcoming The Challenges
Joint Commission - 2010

Monograph authorized by the JC in collaboration with:
1. The Association of Professionals in Infection Control and Epidemiology, Inc.
2. The Centers for Disease Control and Prevention
3. The Institute for Health Improvement
4. The National Foundation for Infectious Diseases
5. The Society for Healthcare Epidemiology of America
6. The World Health Organization World Alliance for Patient Safety

- 232 pages
Technology Support Touted to Increase Hand Hygiene Compliance

- HyGenius System
- iNXT Touchfree Dispensing System
- iScrub Phone App
- nGage System
- Sprixx Personal HH Dispenser
### Summary of Strategies to Improve HH Compliance

<table>
<thead>
<tr>
<th>Routine observation and feedback</th>
</tr>
</thead>
<tbody>
<tr>
<td>Make alcohol-based hand rub available</td>
</tr>
<tr>
<td>Patient education</td>
</tr>
<tr>
<td>Administration sanction</td>
</tr>
<tr>
<td>Avoid excessive workload</td>
</tr>
<tr>
<td>Obtain active participation at individual level</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Many said: For HCWs with high workload and high intensity, use Alcohol-based hand rub:</th>
</tr>
</thead>
<tbody>
<tr>
<td>At entrance of patients’ room</td>
</tr>
<tr>
<td>At bedside</td>
</tr>
<tr>
<td>In pocket</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Educate the HCW:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rational for HH</td>
</tr>
<tr>
<td>Indication for HH</td>
</tr>
<tr>
<td>Technique for HH</td>
</tr>
<tr>
<td>How to keep hands healthy</td>
</tr>
<tr>
<td>Expectation of managers</td>
</tr>
</tbody>
</table>
Examples of What Some Have Done

Michigan Keystone ICU Project

Dartmouth-Hitchcock Anesthesia Provider Project
Michigan Keystone ICU Project
Example of Success

• 2003-2006 - First major HAI project-77 hospitals
• Funded by Agency for Healthcare Research and Quality
• Based on:
  • CDC protocols
  • Addressing teamwork/human factors
  • Fostering a culture of safety
  • Five steps to success: Focus on central-line infections
Five Steps to Success

Hand washing

Using a cap, gown, and mask

Cleaning the patient’s skin with a disinfectant

Avoid placing catheters in the groin

Removing unnecessary catheters
Success

- Cut central-line bloodstream infections to zero
  - 60% of hospitals for 1 year
  - 26% of hospitals for 2 years
- State of Michigan in 3 years
  - Saved 1700 lives
  - Saved $246,000,000
- 2012 - Stimulus for the *American Recovery and Reinvestment Act* of the Department of Health and Human Services (DHHS)
  - $50 million in grants
  - Fight HAIs
- DHHS launched *Hospital Compare*
  - Consumer website for following HAIs in hospitals
Dartmouth-Hitchcock Medical Center
New Hampshire

- Can we improve Hand Hygiene?
- Cultured: APL Valve and IV stopcock
# Methods/Results

<table>
<thead>
<tr>
<th>Event</th>
<th>Did Not Use Point of Contact Alcohol Gel</th>
<th>Used Point of Contact Alcohol Gel</th>
</tr>
</thead>
<tbody>
<tr>
<td># of Anesthesiologists</td>
<td>46</td>
<td>97</td>
</tr>
<tr>
<td>IV stopcock contamination</td>
<td>32.8%</td>
<td>7.5%</td>
</tr>
<tr>
<td>APL Valve contamination (Colonies per surface)</td>
<td>33.6</td>
<td>19.8</td>
</tr>
<tr>
<td>HAI Infections in ICU</td>
<td>17.2%</td>
<td>3.8%</td>
</tr>
<tr>
<td>Hourly decontamination events</td>
<td>0.15</td>
<td>7.1 (Increased 27-fold)</td>
</tr>
</tbody>
</table>
Hand Hygiene is Science!

Research has provided convincing data on:

Hand hygiene and nosocomial infection
Hand Hygiene colonization during patient care
Hand hygiene techniques and agents that do not work
Risk of not practicing hand hygiene
Hand Hygiene can reduce Hospital-Acquired Infections