Overview

- Hand hygiene
- IC activities
- Contact Precautions/ Infection transmission/ CPE screening
- Decontamination/ *M. chimaera*
- HCW vaccination
- *Acinetobacter*, RSV spread by air
- Norovirus spread
- Antimicrobial stewardship
- Chlorhexidine bathing/ FMT for MDROs
- Ebola virus/ PPE doffing
- Zika virus inactivation
Compliance with hand hygiene: reference data from the national hand hygiene campaign in Germany


Institute of Hygiene and Environmental Medicine, Charité – University Medicine Berlin, Berlin, Germany

Hand hygiene surveillance from Germany
Campaign launched 2008
Data from 109 hospitals in 2014
# Hand Hygiene Compliance

## Table II

Hand hygiene (HH) compliance rates by World Health Organization hand hygiene ‘moments’

<table>
<thead>
<tr>
<th>‘Moment’</th>
<th>Indication</th>
<th>Hospitals</th>
<th>Units</th>
<th>Opportunities</th>
<th>Opportunities with HH</th>
<th>Distribution of compliance (P: percentiles)</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Before touching a patient</td>
<td>108</td>
<td>575</td>
<td>29,988</td>
<td>19,949</td>
<td>Mean 67%</td>
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<td>P10 41%</td>
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<td>P25 53%</td>
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<td>P50 67%</td>
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<td>P75 81%</td>
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<td>P90 90%</td>
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<td>2</td>
<td>Before an aseptic procedure</td>
<td>104</td>
<td>566</td>
<td>16,713</td>
<td>11,838</td>
<td>Mean 71%</td>
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<td>P10 40%</td>
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<td>P25 53%</td>
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<td>P50 73%</td>
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<td>P75 89%</td>
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<td></td>
<td>P90 100%</td>
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<tr>
<td>3</td>
<td>After a procedure or body fluid exposure risk</td>
<td>103</td>
<td>560</td>
<td>15,862</td>
<td>12,775</td>
<td>Mean 81%</td>
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<td>P10 57%</td>
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<td>P25 71%</td>
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<td>P50 84%</td>
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<td>P75 96%</td>
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<td>P90 100%</td>
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<td>4</td>
<td>After touching a patient</td>
<td>107</td>
<td>574</td>
<td>34,417</td>
<td>27,338</td>
<td>Mean 79%</td>
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<td>P10 58%</td>
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<td>P25 69%</td>
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<td>P50 81%</td>
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<td>P75 90%</td>
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<td></td>
<td>P90 95%</td>
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<tr>
<td>5</td>
<td>After touching a patient’s surroundings</td>
<td>105</td>
<td>570</td>
<td>23,829</td>
<td>15,549</td>
<td>Mean 65%</td>
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<td>P10 35%</td>
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<td>P25 50%</td>
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<td>P75 80%</td>
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<td>P90 90%</td>
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</tbody>
</table>

Hand Hygiene Compliance

- Median HH compliance 73% (55-89%)
  - Compares with 74% nurses, 54% doctors [Grayson ML, MJA 2011]
- Compliance better in neonatal ICU and paediatric units
- Nurses better than physicians
- AHC effective surrogate marker for HH performance
- Median AHC increase 36% over 3 years and 81% over 8 years
- No evidence of reduction in infection rates
- Minimum compliance threshold of 80% before effect seen
HH in Anaesthetic Care (Sweden)

- Hands of anaesthetic staff are vectors for cross transmission between equipment and patient’s medical devices
- 2393 opportunities for HH observed in 16 ORs
- In full-length surgery mean 10.9/hr (compliance 8.1%)
- In induction phase mean 77.5/hr (compliance 3.1%)
- Low adherence to Swedish & WHO guidelines

Megeus V. Biomed Central 2015
Personalised body-worn HH System

- Delivers AHR and provides time stamp data
- Studied in operating theatre
- 8 fold increase in hand decontamination
- No decrease in HAI

Koff MD. ICHE 2016
Hand Hygiene

- Enhanced performance feedback & patient participation improves HH compliance
  Stewardson AJ. Lancet Inf Dis 2016
- Exceedingly high HH compliance (>95%) reduces HAI rates (by 6%)
  Sickbert-Bennett EE. Emerg Infect Dis 2016
- Emotional motivators increase HH compliance
  - Stir up feelings of disgust via culture plates, ATP monitor readings and HH compliance data
  - 11% increase in compliance
  Gregory A. AJIC 2016
Other Ways To Stir up Feelings

- Repugnance ✓
- Revulsion ✓
- Strong Disapproval ✓
- Hatred ✓
- Loathing ✓
- Abomination ✓
HH to control outbreaks of ESBL-

*Enterobacteriaceae*

- Modeling analysis in the ICU setting
- HH is the most efficient measure in controlling ESBL acquisitions.
- Improving HH compliance from 55% before patient contact and 60% after patient contact to 80% before and after patient contact, would reduce the proportion of patients who acquire ESBLs within 90 days by 91%.
- Adding cohorting reduced acquisition by further 7%
- Antibiotic restriction had the lowest impact

40 IC units
36% of time spent doing surveillance: 56% collecting data, 27% collecting data on compliance with IC activities, 17% feedback of HAI data
Gloves and gowns for all ICU patients
Did not result in a difference in the acquisition rates of the ESKAPE Gram-positives, and VRE
Reduction in MRSA alone
Increased HH on room exit
Decreased HCW visits to rooms

JAMA 2013
Cost of Precautions to Prevent Infection Transmission in Nursing Homes

- Lack of evidence informing guidelines
- Estimated costs of gowns and gloves for:
  - MRSA colonised: $137/res (over 28 days)
  - Chronic skin breakdown: $125/res
  - All residents: $223/res (increase of 123%)
  - Standard precautions: $100/resident
- Effectiveness of these scenarios in prevention of transmission untested and unknown

Roghmann MC. ICHE 2016
CRE Acquisition

- Case-control study
- Risk factors for KPC acquisition among contacts:
  - contact with an index patient for $\geq 3$ days OR, 9.8
  - mechanical ventilation OR, 4.1
  - carriage or infection with another multidrug-resistant organism OR, 2.6

Schwartz-Neiderman A. ICHE 2016
Screening for Carbapenem-Resistant Enterobacteriaceae: Who, When, and How?

Sandra S. Richter & Dror Marchaim

Page 00 | Received 24 Aug 2016, Accepted 25 Oct 2016, Accepted author version posted online: 04 Nov 2016

Download citation http://dx.doi.org/10.1080/21505594.2016.1255381 Crossmark

4006 rectal swabs collected. 3 lab methods used 6 isolates from 5 patients +ve, 93% had at least 1 negative culture of 3. Overseas hospitalization was the only significant risk factor for CPE carriage (P < 0.001, OR 64.3, 95% CI 7.3–488.5).
To confirm intra-institutional spread of MRSA, VRE, MDR *E. coli* & *P. aeruginosa*

202 Euro ($291 Aus) per isolate with avoided costs of 317,180 Euro
Optimum UV (Chlorox)

Easy to use touch screen
Remote control
Cycle completion verification

Safety
Maneuverability
Lightweight
Decontamination

- Contaminated environment may be a source of MDRO transmission
- Ultraviolet-C device (Optimum UV) tested against MRSA and CRE with 5 minute cycle time
- $5.01-5.87 \log_{10}$ reduction for CRE (1-2 cycles)
- $4.61-5.06 \log_{10}$ reduction for MRSA (1-2 cycles)
- More effective when sites were in direct line of site ($>5$ log compared with $>4$ log reduction)

Kanamori H. ICHE 2016
CRE Decontamination

- Ultraviolet-C device (Optimum UV) tested against CRE on high-touch surfaces with 5 minute cycle time x 3
- 1.5% of plates grew CRE after UV-C
- 6 log$_{10}$ reduction in CRE
- No difference between 3 organisms (K. pneumoniae, E. Coli, E. Cloacae)
- Data on reduced infection transmission required

Rock C. ICHE 2016
Plasmair Decontamination

- Mobile air decontamination (Airinspace), with data on efficacy from 2007
- Patients with chemotherapy-induced neutropaenia in Plasmair-equipped rooms were significantly less likely to develop invasive aspergillosis (OR = 0.11)
- Cost?
- Weight 185 kg

Fernandez-Gerlinger MP. ICHE 2016
Exhaust air from contaminated HCU's (3T) can transmit aerosols with *M. chimaera* to the operating field under ultraclean laminar air flow ventilation
Mycobacterial sampling of all HCUs in use in Western Australia was initiated from August 2015, revealing *M. chimaera* colonisation in 10 of 15 HCUs.
Many U.S. states enacted laws after 2006 requiring HCW influenza vaccination

States with these laws had increased vaccination rates
Methods to Increase HCW Vaccination rates

- Free vaccine at workplace ✓
- Education ✓
- Publicity ✓
- Incentives ✓ ✗
- Mobile carts ✓
- Feedback/ reporting rates to administration ✓
- Signed declinations ✗
- Mandates ✗
Air Contamination With *Acinetobacter*

Potential for airborne spread reported previously

Allen KD. *J Hosp Infect* 1987

Munoz-Price LS  *Crit Care Med* 2013

12/53 (22.6%) trauma ICU patient areas +ve for AcB

Colonized or infected patient associated with +ve air cultures
Air Contamination With *Acinetobacter*

- University of Maryland ICUs
  - Air sampled around 12 infected or colonized patients
  - 1/12 air +ve (7/12 closed-circuit ventilation, 8/12 on antibiotics active against AcB)
  - “Infrequent Air Contamination”

Contamination of Ambient Air with *Acinetobacter baumannii* on Consecutive Inpatient Days

Luis A. Shimose, Yohei Doi, Robert A. Bonomo, Dennise De Pascale, Roberto A. Viau, Timothy Cleary, Nicholas Namias, Daniel H. Kett, L. Silvia Munoz-Price

Department of Medicine, Miller School of Medicine, University of Miami, Miami, Florida, USA; Division of Infectious Diseases, University of Pittsburgh School of Medicine, Pittsburgh, Pennsylvania, USA; Division of Infectious Diseases and HIV Medicine, University Hospitals of Cleveland, Cleveland, Ohio, USA; Departments of Medicine, Molecular Biology and Microbiology, and Pharmacology, Case Western Reserve University School of Medicine, Cleveland, Ohio, USA; Department of Pathology, Miller School of Medicine, University of Miami, Miami, Florida, USA; Department of Surgery, Miller School of Medicine, University of Miami, Miami, Florida, USA; Institute of Health and Society, Medical College of Wisconsin, Milwaukee, Wisconsin, USA; Department of Medicine, Medical College of Wisconsin, Milwaukee, Wisconsin, USA; Jackson Memorial Hospital, Miami, Florida, USA; Division of Infectious Diseases, MetroHealth Medical Center, Cleveland, Ohio, USA

*Acinetobacter*-positive patients had their ambient air tested for up to 10 consecutive days. The air was *Acinetobacter* positive for an average of 21% of the days; the rate of contamination was higher among patients colonized in the rectum than in the airways (relative risk [RR], 2.35; *P* = 0.006). Of the 6 air/clinical isolate pairs available, 4 pairs were closely related according to rep-PCR results.

- Air samples +ve in 26% of rectally colonised
- Air samples +ve in 11% of resp colonised

**Relationship to site of colonisation?**

Shimose LA. J Clin Micro 2015
Acinetobacter in the Air: Did Maryland Get It Wrong?

L. Silva Manuse-Prieto, MD, PhD

(See the article by Rock et al, on pages 836-832.)

In this issue of Infectious Control & Hospital Epidemiology, Rock and colleagues present their experience culturing the air of patients colonized or infected with Acinetobacter baumannii. The authors used an air impacting to culture the ambient air of 12 patient rooms. They found only 1 patient with A. baumannii present in ambient air. This is in contrast to what has been previously identified elsewhere.1-4

Let's go over some potential explanations of these findings. Obviously, the first thought that came to mind was to do with the study design itself. On the basis of Shinmen's article in regard to Staphylococcus aureus,2 air contamination would seem to be associated with activities occurring in the patient's room. Thus, air contamination might lead to a constant function ever time, and random 3-hour samples per unique patient might not provide the full picture of what is occurring with the ambient air throughout the day. Our group recently detected sporadic air contamination using an air culturing machine throughout continuous 6-hour observations per unique patient (Manuse-Prieto, unpublished data). Additionally, using 24-48-hour settle plates (a rather insensitive method), we previously found up to 40% of ambient air contamination.

Setting the design aside, what other factors might be contributing to the results of Rock and colleagues? Most certainly the heating, ventilating, and air conditioning (HVAC) system of their hospital. According to the US Energy Information Administration,5 an American hospital’s square foot electrical cost is approximately $2.84 per year, of which ventilation and cooling comprised 5% (approximately $0.14 per square foot). Even though costs do not seem to be increasing in the nation as a whole, certain regions of the country have seen rising electrical costs, such as Alaska, Hawaii, California, the Southwest, and the Gulf Coast. From this list, it would seem intuitive that warmer climates might be playing a role on the differential rise in electrical costs. Lastly, in my discussion of HVAC systems with a trade expert, frequent anecdotal observations at American healthcare facilities include: (1) the failure by healthcare facility directors to perceive a connection between poor HVAC operations and the potential patient safety implications; (2) the constant pressure of facility directors to decrease costs, resulting in short-term solutions; (3) the poor coil cleaning methods (or even complete absence of coil cleaning), which results in restriction of airflow and inability of the system to cool the air—consequently, these situations result in increased ambient temperature and higher humidity, which are frequently remedied by the removal of filters (increasing airflow but removing filtration) rather than by cleaning the cooling coils or replacing the filters; (4) the tendency of hospitals to recirculate cool air with negligible cooling capacity in order to decrease electricity costs; and (5) the lack of regular monitoring of filters, existence of by-pass leaks, or filter life cycle status.

As professionals within the field of infection control, we all know that hospitals frequently have to make hard decisions based on budget. Some administrative decisions are obvious (and common) to infection control departments include changing nursing staffing and environmental personnel. In infection control, we know that these decisions have an impact on patient safety outcomes. Considering that HVAC systems are expensive to run and are not seen by most healthcare workers, wouldn’t it be reasonable to consider that similar budgetary decisions are occurring on matters that we cannot readily see? How do variables such as temperature and humidity outside the facility, age of the infrastructure, and economic viability of the hospital affect decisions regarding cleaning HVAC system costs? It is reasonable to wonder whether the number of air changes per hour, comfort cooling and humidity settings in a new,

Is airborne transmission of Acinetobacter baumannii possible: A prospective molecular epidemiologic study in a tertiary care hospital

Yusuf Yagupozgullari, MD, Bans Dilu, PhD, Yasemin Ersoy, MD, Cigdem Kuzucu, MD, Yasar Bayindir, MD, Uner Kayabas, MD, Turkan Togal, MD, Cennet Kizilkaya, PhD

YES- 11% of air samples in ICU +ve

NO- nil detected
Carbapenem R *Acinetobacter* in Air & Environment

- Rectal colonisation:
  - 38.3% air samples +ve
  - 15.5% environmental samples +ve
- Resp colonisation:
  - 13.1% air samples +ve
  - 9.5% environmental samples +ve

Relationship to closed-circuit ventilation?

Shimose LA. ICHE 2016
Evidence of Respiratory Syncytial Virus Spread by Aerosol. Time to Revisit Infection Control Strategies?

Hemant Kulkarni¹, Claire Mary Smith², Dani Do Hyang Lee², Robert Anthony Hirst¹, Andrew J. Easton³, and Chris O’Callaghan²

Received: September 17, 2015   Accepted: February 16, 2016

DOI: http://dx.doi.org/10.1164/rccm.201509-1833OC

Abstract

Rationale: Respiratory syncytial virus (RSV) is a highly contagious pathogen with a huge global health impact. It is a major cause of hospital-acquired infection; a large number of those exposed develop infection. Those infected in hospital are at increased risk of a severe clinical course. Prevention of nosocomial spread currently focuses on spread by hand and large droplets. There is little research evidence to determine if aerosol spread of infectious RSV is possible.

Babies with bronchiolitis due to RSV Particles can be aerosolised
48 air samples collected during Norovirus outbreaks in 8 healthcare facilities
1 metre away from patient, in front of patient room and at nurses station
Detected Norovirus in 6 of 8 facilities. Norovirus RNA was detected in 14 of 26 symptomatic patients’ rooms (54%), 6 of 16 hallways (38%), and 3 of 6 nurses’ stations (50%).
Vomiting as a Symptom and Transmission Risk in Norovirus Illness: Evidence from Human Challenge Studies

Amy E. Kirby, Ashleigh Streby, Christine L. Moe

Published: April 26, 2016 • http://dx.doi.org/10.1371/journal.pone.0143759

Epidemiology & Infection

Norovirus gastroenteritis outbreak transmitted by food and vomit in a high school

P. Godoy, M. Alsedà, R. Bartolomé, D. Clavería, I. Mópol, P. Bach, G. Mirada and À. Domínguez

DOI: http://dx.doi.org/10.1017/S0950268815003283
Published online: 13 January 2016

Fig. 3: Bathroom Contaminated with Infectious Bacteria

- Toilet lids
- Environmental cleaning
- Isolation & PPE
Antimicrobial Stewardship

- Intervention to decrease unnecessary Rx of asymptomatic bacteriuria
  - 3 hospitals in Michigan
  - Education of hospitalists (general physicians)
  - Provision of pocket cards with appropriateness criteria
  - Prescribing rates decreased by 23.5%

Hartley SE, ICHE 2016;37:1044-51
Automatic End Dates for Antimicrobials

- End dates or “auto-stop” were included in approving restricted agents
- Children’s hospital
- No change in mortality, readmission rates, LOS
- In bacteraemia cohort, no difference in mortality, readmission rates or LOS compared with preintervention
- IDSA and CDC favour auto-stop policies

Ross RK. ICHE 2016
Daily bathing with chlorhexidine in 5 ICUs did not reduce the incidence of health care–associated infections including CLABSIs, CAUTIs, VAP, or *C. difficile*.

In contrast to previous studies (Climo et al) this study has methodological limitations.

Editorial by Pittet & Angus
ICU patients in 43 hospitals
Chlorhexidine bathing and intranasal mupirocin, including cleaning perineum and proximal 6 inches of IDC
Reduced candiduria and bacteriuria in men (not women)
FMT

- Fecal Microbiota Transplantation (FMT) has proven efficacy in Clostridium difficile infection.
- Could considerably impact the prevention of CRE and ESBL infections and acquisitions.
- Trials of FMT for decolonization of MDR-GNBs are currently underway with initial promising results.

Infection Prevention and Control for Ebola in Health Care Settings — West Africa and United States

Summary

The 2014–2016 Ebola virus disease (Ebola) epidemic in West Africa underscores the need for health care infection prevention and control (IPC) practices to be implemented properly and consistently to interrupt transmission of pathogens in health care settings to patients and health care workers. Training and assessing IPC practices in general health care facilities not designated as Ebola treatment units or centers became a priority for CDC as the number of Ebola virus transmissions among health care workers in West Africa began to affect the West African health care system and increasingly more persons became infected. CDC and partners developed policies, procedures, and training materials tailored to the affected countries. Safety training courses were also provided to U.S. health care workers intending to work with Ebola patients in West Africa. As the Ebola epidemic continued in West Africa, the possibility that patients with Ebola could be identified and treated in the United States became more realistic. In response, CDC, other federal components (e.g., Office of the Assistant Secretary for Preparedness and Response) and public health partners focused on health care worker training and preparedness for U.S. health care facilities. CDC used the input from these partners to develop guidelines on IPC for hospitalized patients with known or suspected infectious disease.
Countries with Former Widespread Transmission and Current, Established Control Measures

<table>
<thead>
<tr>
<th>Country</th>
<th>Total Cases (Suspected, Probable, and Confirmed)</th>
<th>Laboratory-Confirmed Cases</th>
<th>Total Deaths</th>
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<tbody>
<tr>
<td>Guinea</td>
<td>3814</td>
<td>3358</td>
<td>2544</td>
</tr>
<tr>
<td>Sierra Leone</td>
<td>14124</td>
<td>8706</td>
<td>3956</td>
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<tr>
<td>Liberia</td>
<td>10678</td>
<td>3163</td>
<td>4810</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>28616</strong></td>
<td><strong>15227</strong></td>
<td><strong>11310</strong></td>
</tr>
</tbody>
</table>

IPC specialists in Guinea, Sierra Leone, and Liberia
Infection Control for Ebola (July, 2016)

- Triage procedures at key health care facilities for screening suspected cases at entry points.
- HCWs using appropriate PPE
- IPC improvements
  - waste management, hand hygiene, environmental decontamination
- Local infrastructure essential: PPE, clean water, electricity, waste disposal, local production of alcohol-based handrub
- Distant training: sustaining the education, training, and competency of HCWs on IPC practices
Doffing
Self-Contamination Doffing PPE

- Self-contamination of hands during doffing is common with standard PPE
  Tomas ME. JAMA Intern Med 2015
- Fluorescent marker detected contamination after Ebola PPE doffing
  Bell T. ID cases 2015
- No data on enveloped viruses to date
Self-Contamination During Removal of Ebola PPE

- Experimental using surrogate viruses
- 15 HCWs had virus applied to PPE
- Structured doffing protocol with trained monitor
- 10/15 ABHR, 5/15 hypochlorite for gloves and HH
- Non-enveloped virus detected:
  - Dominant hand inner glove 8/15 \(\{\) ABHR used
  - Non-dominant inner glove 6/15 \(\}\) ABHR used
  - Scrubs 2/15, Hands 1/15

Casanova LM, ICHE 2016
Conclusions about PPE Doffing for Ebola

- Inner gloves play a vital role.
- Post doffing showering with chlorhexidine recommended
- **Enveloped** surrogate virus was not detected on any gloves
- Current protocols with ABHR are adequate to prevent self-contamination with enveloped virus
- Low level hand contamination must still be a risk in doffing.
- HH after doffing is vital.
Zika Virus in the Americas — Yet Another Arbovirus Threat

Anthony S. Fauci, M.D., and David M. Morens, M.D.
Inactivation of Zika virus in plasma with amotosalen and ultraviolet A illumination

- Arthropod-borne virus transmitted by mosquitoes.
- Potential for ZIKV transmission through blood transfusion because donors asymptomatic.
- A photochemical treatment inactivated ZIKV in fresh-frozen plasma.
- Previously successful with DENV, WNV, CHIKV.
- Implication is for prevention of plasma transfusion-transmitted ZIKV infections in areas with endemic circulating pathogens.

Aubry M. Transfusion 2016;56:33-40
Conclusions

- HH still as important as ever and still done poorly
- Some novel strategies to improve HH
- Gloves and gowns expensive and effectiveness in infection prevention not proven in all settings
- Mixed data on chlorhexidine bathing
- Evidence of effectiveness of decontamination with UV-C device
- Airborne spread of *Acinetobacter*, *Norovirus* & *RSV*
- Auto stop dates for antibiotics not harmful
- Contamination post PPE doffing proven