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State of the Art Clinical Debate: Baring It All – or Not

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Be it resolved that healthcare workers **should be encouraged** to remain bare below the elbows and **avoid the use of personal items** in the patient care setting, which may act as fomites and promote the spread of potential pathogens.

Objectives (from my perspective)

- At the end of this debate, you will be able to:
 - Describe the role of the unhygienic HCW (and his/her dirty devices) in the transmission of infection
 - Identify some strategies to protect our patients from the unhygienic health care worker
 - Do the right thing

Educate & Entertain
(realizing I am not Jay Keystone!)

Physical contact with patients

- Common points of contact
 - Hands & wrists
 - wristwatch
 - Sleeves
 - Front of clothing
 - Necktie
 - Stethoscope

Definition – Bare Below the Elbow

Elements

- No white coat
- **Short sleeves**
- No neck tie
- **No wristwatch**
- **No jewellery except for wedding band**

Rationale

- Facilitate good hand hygiene
- Avoid contamination (maybe hands aren't the only vector)

Personal devices

Baring it all – or not

BUILDING THE CASE

The mechanism

Patient's skin & environment are contaminated with potential pathogens



HCW's clothing & devices become contaminated via contact with patient and patient environment



Pathogen(s) transmitted from HCW to patient

Contamination of white coats

Year	Methodology	Findings
1991 ¹	Cross-sectional survey Bacterial contamination of WCs	25% of WCs had MSSA (cuffs, pockets) Degree associated with increased use & not related to perceived cleanliness
2000 ²	Random sample (n=100) Cultured medical students WCs	All coats contaminated to varying degrees Sleeve more likely to be heavily colonized than the back (p <0.001)
2001 ³	Cross-sectional sample (n=57) Bacterial contamination belt-hem	MRSA, VRE, <i>C.difficile</i> recovered Shift start 39% of uniforms with ≥ 1 microorganism Shift end 54% of uniforms with ≥ 1 microorganism
2009 ⁴	Cross-sectional study (n=149) Sampled WCs for growth	<i>S. aureus</i> grown from 23% WCs (18% MRSA) No VRE
2011 ⁵	Cross-sectional sample (n=135) Sampled WCs/uniforms	63% contaminated with potential pathogens

1. BMJ 1991; 303:1602-4
2. JHI 2000; 45:65-8
3. JHI 2001; 48:238-41
4. Am J Infect Control 2009; 37:101-5
5. Am J Infect Control 2011; 39:555-9

Persistence of bacteria on fabrics

Microbe	# tested	Survival (# days)		
		<u>Cotton</u>	<u>Blend</u>	<u>Polyester</u>
MSSE	3	8,16,21	6,6,7	7,10,16
MRSE	3	14,18,20	20,22,28	16,20,22
MSSA	3	4,5,19	1,9,21	10,12,56
MRSA	3	4,5,21	1,3,3	11,16,40
VRE	4	18,22,62, >90	18,22,52, >90	73, >80 (2), >90

Persistence of fungi on fabrics

Microbe	# tested	Survival (# days)		
		<u>Cotton</u>	<u>Blend</u>	<u>Spandex</u>
<i>C. albicans</i>	2	1,3	1,3	3,4
<i>A.fumigatus</i>	3	1,10,>30	3,3,>30	5,>30(2)
<i>Fusarium</i>	1	10	10	10
<i>Mucor</i>	1	21	20	>30

Laudering – an anonymous survey

Uniform	Provider		
	<u>Faculty</u>	<u>Housestaff</u>	<u>Student</u>
Whitecoat	12.8 ± 2	12.6 ± 1.6	11.4 ± 2.4
Scrub	1.3 ± 0.2	1.9 ±	1.8 ± .4
WC vs scrub	<.001	<.001	<.001

4 people laundered at intervals > 90 days!

Laundering

Frequency	No. (%) of respondents		
	<u>Attendings</u>	<u>Residents</u>	<u>Med students</u>
Daily	1/44 (2)	1/79 (1)	2/183 (1)
Q 2 days	2/44 (5)	0/79	3/183 (2)
Weekly	17/44 (39)	24/79 (30)	72/183 (39)
Monthly	18/44 (41)	34/79 (43)	74/183 (40)
Never	6/44 (14)	20/79 (25)*	32/183 (17)

57% launder their white coats
monthly or less often

Transfer of pathogens from fabric

Table I

Growth of organisms at serial dilutions (beginning at 0.5 McFarland)

Organism	Time (min)	Dilution of organisms				
		1	1:100	1:1000	1:10 000	1:100 000
MRSA	1	+	+	-	-	-
	5	+	+	-	-	-
	30	+	+	-	-	-
VRE	1	+	+	-	-	-
	5	+	+	-	-	-
	30	+	+	-	-	-
PRA	1	+	+	-	-	-
	5	+	+	-	-	-
	30	+	+	+	-	-

+, growth of organism; -, no growth of organism; MRSA, meticillin-resistant *Staphylococcus aureus*; VRE, vancomycin-resistant *Enterococcus faecium*; PRA, pan-resistant *Acinetobacter baumannii*.

Transfer of pathogens to a mannequin

Table I

Total colony counts of micrococcus cultured from the mannequins after examination according to the four combinations of dress

Total colony counts	With tie	Without tie
Long sleeve shirt	24	1
Short sleeve shirt	2	0

Table II

Number of contaminated mannequins after examination according to the four combinations of dress

No. of colonized mannequins	With tie	Without tie
Long sleeve shirt	4 of 5	1 of 5
Short sleeve shirt	2 of 5	0 of 5

Environmental contamination

Table 1. Summary of nosocomial pathogens and environmental contamination.

Pathogen	Types of environmental contamination	Length of survival of organism	Evidence of transmission ^a	Recommended isolation precautions [2]	Recommendations for decontamination
Influenza virus	Aerosolization after sweeping [3]; survival on fomites	24–48 hours on nonporous surfaces [3]	Fomite to hands of HCW ^b [3]	Droplet	Standard EPA-approved disinfectant or detergent-disinfectant [4]
Parainfluenza virus	Survival on clothing and nonporous surfaces [5]	10 hours on nonporous surfaces; 6 h on clothing [5]	Not proven	Contact ^c	Standard EPA-approved disinfectant or detergent-disinfectant [4]
Noroviruses	Persistent outbreaks on ships [6]; extensive environmental contamination [7]; possible aerosolization [8]	≤14 days in stool samples [6]; ≤12 d on carpets [7]	Not proven	Standard	10% Sodium hypochlorite solution or other germicide [6]
Hepatitis B virus	Environmental contamination with blood	7 days [9]	Lancets, EEG electrodes in outbreaks [10, 11]; nosocomial transmission to HCW	Standard	Standard EPA-approved disinfectant or detergent-disinfectant [4]
SARS-associated coronavirus	Positive results of cultures of samples from an ED environment [12]; high–secondary attack rate events (i.e., super spreading events) ^d [15]	24–72 hours on fomites and in stool samples [13]	Not proven but suspected; clothing not clearly affected	Airborne, contact, and personal protective equipment	Standard EPA-approved disinfectant or detergent-disinfectant [14]
<i>Candida</i> species	Contamination of fomites [16]	3 days for <i>Candida albicans</i> [17] and 14 days for <i>Candida parapsilosis</i> [17]	Suggested by molecular epidemiologic findings [16]	Standard	Standard EPA-approved disinfectant or detergent-disinfectant [4]
<i>Clostridium difficile</i>	Extensive environmental contamination [18–20]	5 months on hospital floors [19]	Correlation between degree of environmental contamination and HCW hand contamination [18]	Contact	Hypochlorite-based (sporicidal) products [4]
<i>Pseudomonas aeruginosa</i>	Contamination of sink drains [21]	7 hours on glass slide [22]	Multiple types in environment that do not correlate with acquisition [23]; most acquisition is endogenous [21]	Contact ^e	Standard EPA-approved disinfectant or detergent-disinfectant [4]
<i>Acinetobacter baumannii</i>	Extensive environmental contamination [24, 25]	33 days on plastic laminate surfaces [26]	Multiple types in environment that do not correlate with acquisition [27]	Contact ^e	Standard EPA-approved disinfectant or detergent-disinfectant [4]
MRSA	Burn units extensively contaminated [28]	≤9 weeks after drying [29]; 2 days on plastic laminate surfaces [30]	Evidence of environment-to-HCW spread [28]; phage types in environment discordant with patient phage types [31]	Contact	Standard EPA-approved disinfectant or detergent-disinfectant [4]
VRE	Extensive environmental contamination [32–34]	≤58 days on countertops [35]	Environment-to-HCW spread [36]; high risk of acquisition by patients in contaminated rooms [37]	Contact	Standard EPA-approved disinfectant or detergent-disinfectant [4]

NOTE. ED, emergency department; EEG, electroencephalographic; EPA, Environmental Protection Agency; HCW, health care worker; MRSA, methicillin-resistant *Staphylococcus aureus*; SARS, severe acute respiratory syndrome; VRE, vancomycin-resistant enterococci.

Contaminated personal devices

- Cell phones from 288 health care providers
 - 43% positive for a microorganism
 - 53% of physician's cell phone
 - *S. aureus* (33%), CoNS (22.9%), *E. coli* (12.8), *Acinetobacter* (9.1%), enterococcus (9.1%)

AJIC 2010; 38: 404-5

- Mobile phones of 200 HCWs
 - 94.5% had bacterial growth
 - *S. aureus* (52%), GN (31.3%)

Ann Clin Microbiol Antimicrob 2009; 8:7

Contaminated bedside computer keyboards (& faucets)

- Contamination rates in occupied rooms
 - Computer keyboards: 26%
 - Faucet handles: 15%
- Contamination rates in non-occupied rooms
 - Computer keyboards: 17%
 - Faucet handles: 0
- 49% of isolates were MRSA and 33% GNR

Contaminated bedside computer keyboards

Microbial growth	ICU		IM	
	<u>Baseline</u>	<u>After cleaning</u>	<u>Baseline</u>	<u>After cleaning</u>
Negative	11.4%	55.5%	0	17.4%
Minimum risk	11.4%	4.3%	34.8%	12%
Moderate risk	40%	25.7%	42.4%	33.7%
High risk	37.1%	14.3%	22.8%	37%

Contaminated iPads

- Devices used in the inpatient & outpatient clinical setting by pharmacists (n=30)
- All culture positive
- Inpatient isolates
 - CoNS 100%
 - *S. aureus* 71.4%
 - GNR 100%

Summary of evidence

Component	Evidence
Pathogens contaminate patient's skin & environment	Conclusive
HCW clothing & devices contaminated	Conclusive
Clothing & devices can transmit pathogens	In vitro evidence
BBE and leaving devices out of patient care space decreases infection	No evidence

Justification to act on biologic plausibility

Potential for benefit

No risk for harm

Minimal cost

Be it resolved that healthcare workers **should be encouraged** to remain bare below the elbows and **avoid the use of personal items** in the patient care setting, which may act as fomites and promote the spread of potential pathogens.