The Microbiology NETWORK

Cross Contamination at the Point of Care

Can it be controlled?

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Presentation Outline

- Hospital Acquired Infections (HAI) are a significant problem
- HAI can be reduced by appropriate procedures
- How can cross contamination occur?
- Case Study : Assisted Monitoring of Blood Glucose

HAI is a Significant Problem

- CDC estimates cost of HAI at $35.7 billion - $45 billion in 2007
- $20,549 – $20,903 per patient

Scott, RD. 2009. The Direct Medical Costs of Healthcare-Associated Infections in U.S. Hospitals and the Benefits of Prevention. CDC Publication.

HAI Results in Longer Stays

- Average increase of 19.2 days
- Study suggests increase cost per patient affected of $43,000

Lucado, J, *et al.* 2010. Adult Hospital Stays with Infections Due to Medical Care, 2007. HCUP Statistical Brief #94. AHRQ.

A question for you…

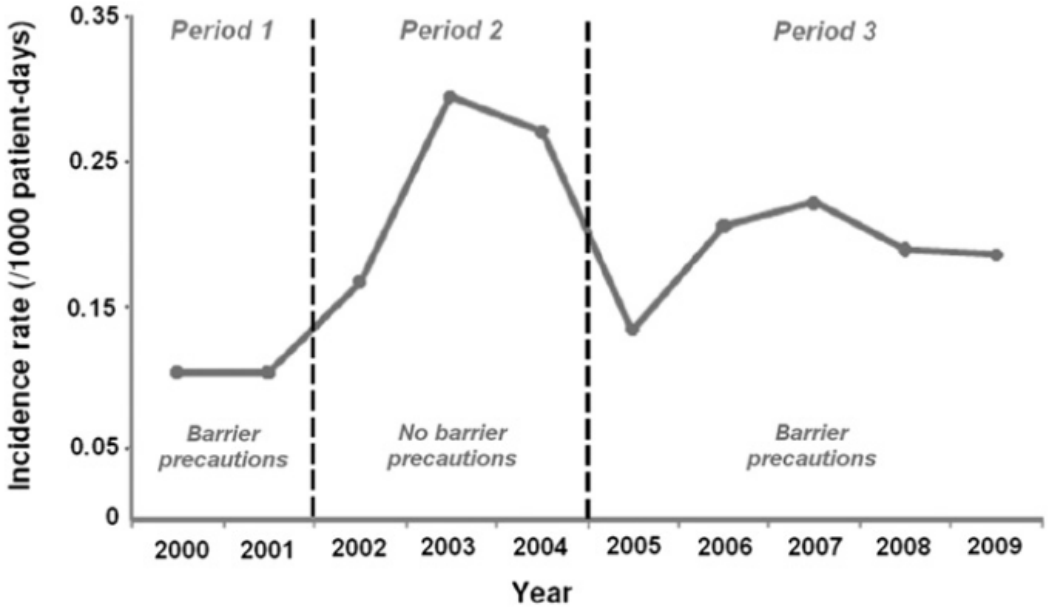
The importance of prevention

- Study looked at contamination control practices in California
- Wide variation in specific activities - the most focus placed on MRSA.
- Only significant effector seen in lowering rates was the presence in hospital of certified infection control director.

Pogorzelska, M, *et al.* 2012. Certification in infection control matters: Impact of infection control department characteristics and policies on rates of multidrug-resistant infections. *Amer J Infect Control* 40:96-101

Barrier Precautions Work

- Ecological study assessing the impact of barrier precautions
- Followed the annual incidence rate of acquired *Acinetobacter baumannii* cases in University Hospital of Besançon from 2000 to 2009.
- This study confirms the effectiveness of barrier precautions.



Lefebvre, A, *et al.* 2011. Impact of barrier precautions and antibiotic consumption on the incidence rate of acquired cases of infection or colonization with *Acinetobacter baumannii*: A 10-year multi-department study. *Amer J Infect Control* 39(10):891-894.

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Surfaces in Hospital Rooms can be Contaminated

- 50 rooms sampled, 10 surfaces each
- 48%(24/50) were positive at 1 or more
- Supply carts (16/50,20%)
  - Floors (8/50, 16%),
  - Infusion pumps (7/50, 14%)
  - Ventilator touch pads (5/44, 11.4%)

Authors conclusion:
"Surfaces often touched by health care workers during routine patient care are commonly contaminated and may be a source of nosocomial spread."

Thorn, KA, et al. 2011. Environmental contamination because of multidrug-resistant *Acinetobacter baumannii* surrounding colonized or infected patients. *Amer J Infect Control* 39(9):711-715

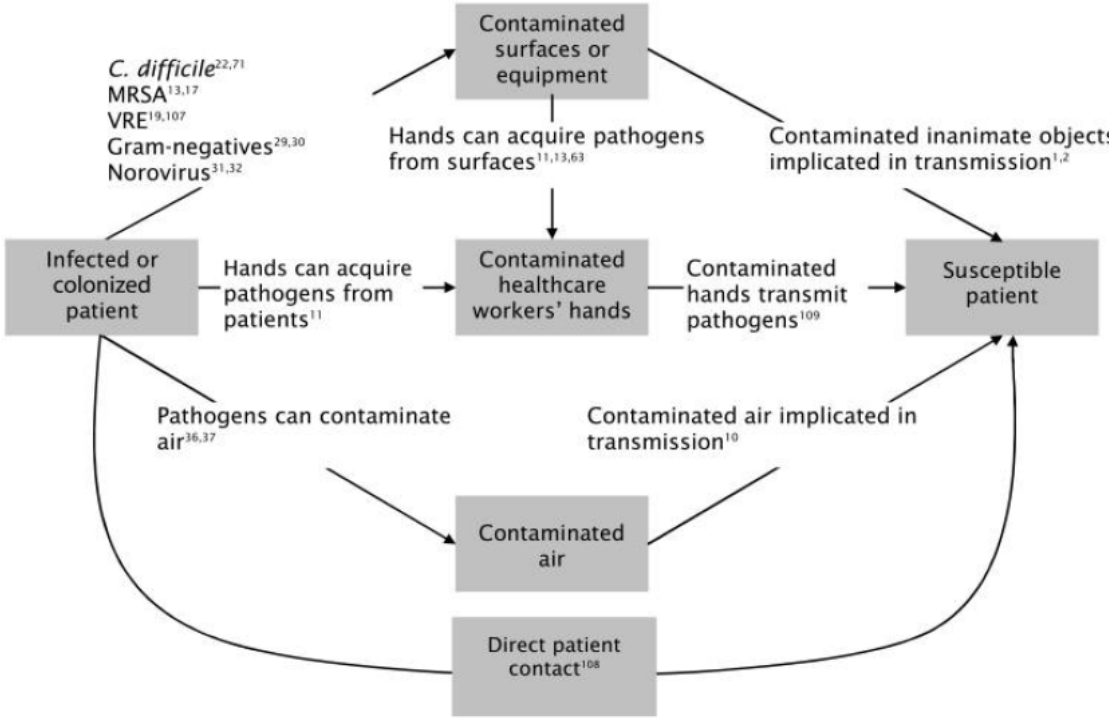
Organisms can Survive on Surfaces

Organism	Duration
Most gram(+) bacteria, such as *Enterococcus* spp. (including VRE), *S. aureus* (including MRSA), or *Streptococcus pyogenes*	Months
Many gram(-) species, such as *Acinetobacter* spp., *E. coli, Klebsiella spp., Pseudomonas aeruginosa, Serratia marcescens*, or *Shigella* spp	Months
Many gram(-) species, such as *Bordetella pertussis, Haemophilus influenzae, Proteus vulgaris,* or *Vibrio cholerae*	Days
Yeast	Days - Months
Respiratory Viruses	Days
Gastrointestinal Viruses	2 months
Blood-borne Viruses	Hours - days

Kramer, A, *et al.* 2006. How Long do Nosocomial Pathogens Persist on Inanimate Surfaces? A Systematic Review. *BMC Infect Dis.* 130:1-8

A question for you…

Surfaces in Hospital Rooms Can Serve as a Vector of Transmission



Otter, JA, *et al.* 2011. The Role Played by Contaminated Surfaces in the Transmission of Nosocomial Pathogens. *Infect Control Hosp Epidemiol* 32(7):687-699

Bacterial Contamination of Uniforms

Table II *Levels of contamination on uniforms at the start and end of a span of duty*

Organism	Area	1–10 cfus		10–100 cfus		> 100 cfus	
		Before duty	After duty	Before duty	After duty	Before duty	After duty
Methicillin-resistant *Staphylococcus aureus*	Surgery	0	0	1	1	0	0
	Renal	0	0	0	3	5	1
	Medicine	0	0	1	2	0	1
	Obstetrics	0	0	0	0	0	0
Vancomycin-resistant enterococci	Surgery	0	0	0	0	0	0
	Renal	10	18	0	0	0	0
	Medicine	0	4	1	0	1	0
	Obstetrics	0	0	0	0	0	0
Clostridium difficile	Surgery	0	0	0	0	0	0
	Renal	4	4	0	0	0	0
	Medicine	3	7	0	0	0	0
	Obstetrics	0	0	0	0	0	0
Total		17	33	3	6	6	2

Perry, C *et al*. 2001. Bacterial contamination of uniforms. *J Hosp Infect.* 48:238–241

Healthcare Provider – White Coats

- A cross-sectional study
- 149 grand rounds attendees' white coats
  - 34 (23%) were contaminated with *S. aureus*, 6 (18%) were MRSA.
  - None of the coats was contaminated with VRE
- Contamination was more prevalent in residents, those working in inpatient settings, and those who saw an inpatient that day
- White coats may be an important vector for patient-to-patient transmission of *S aureus*

Treakle, AM, *et al.* 2009. Bacterial contamination of health care workers' white coats. *Amer J Infect Control* 37(2):101-105

White Coats Out of Laundry

- 29 unwashed hospital operating room scrub swatches analyzed, 23 (79%) were positive for some type of gram-positive cocci
  - 10% of these *S aureus*
  - 69% were positive for coliform bacteria
- Home-laundered scrubs had a significantly higher total bacteria count than hospital-laundered scrubs (P =.016).
- No statistical difference counts between hospital-laundered scrubs and unused new and disposable scrubs.

Nordstrom, JM. 2011 (online) Comparison of bacteria on new, disposable, laundered, and unlaundered hospital scrubs. *Amer J Infect Control* Preprint

Other Articles of Interest

- Weiner-Well, Y, *et al.* 2011. Nursing and physician attire as possible source of nosocomial infections. *Amer J Infect Control.* 39(7):555-559
- Barbieri, RL. 2008. The hospital has a new dress code for its vectors—er, doctors. *OBG Management* 20(11):6-8
- Loh, W, *et al.* 2000. Bacterial flora on the white coats of medical students. *J Hosp Infect* 45:65-68

Handwashing

- Hand-hygiene compliance among clinical staff before and after entry was 25%
  - Higher compliance during summer periods (47%)
  - Winter periods (7%)
- More than half of the staff (58%) touched the patient.
- Staff were more likely to clean their hands prior to contact with a patient and sites beside the patient
- Nearly half (48%) handled patient notes and 25% touched the bed.
- Most frequently handled equipment inside room
  - Intravenous drip (30%)
  - Computer (26%)
  - Notes trolley (23%)
  - Blood pressure stand (13%)

Smith, SJ, *et al* 2012. Where do hands go? An audit of sequential hand-touch events on a hospital ward *J Hosp Infect* 80(1):206-211

Clean Hands Become Contaminated by Patient

- 131 HCW observations
- 103 HCWs whose hand samples were negative for VRE when they entered the room
  - 52% contaminated their hands or gloves after touching the environment
  - 70% contaminated their hands or gloves after touching the patient and the environment

Hayden, MK, *et al* 2008. Risk of Hand or Glove Contamination After Contact With Patients Colonized With Vancomycin-Resistant Enterococcus or the Colonized Patients' Environment. *Infect Control Hosp Epidemiol* 29(2):149-154

Handwashing

"Hand hygiene is the leading measure for preventing the spread of antimicrobial resistance and reducing healthcare-associated infections (HCAIs), but healthcare worker compliance with optimal practices remains low in most settings."

Allegranzi, B and D. Pittet. 2009. Role of hand hygiene in healthcare-associated infection prevention. *J Hosp Infect* 73:305-315

Other Handwashing Articles of Interest

- Pittet, D and JM Boyce. 2001. Hand hygiene and patient care: pursuing the Semmelweis legacy. *Lancet Infect Dis* April, 2001. pp.9-20
- Boyce, JM and D Pittet. 2002. Guideline For Hand Hygiene In Health-Care Settings: Recommendations of The Healthcare Infection Control Practices Advisory Committee and the HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force. *Infect Control Hosp Epidemiol* 23[suppl]:S3-S40

Personal Products - Pens

- Study found 100% contamination of pens
- Pathogens:

Pathogens isolated	No of colonies		
	Chief	Consultant	Registrar
CNS	29 (5/6)	38 (8/9)	62 (17/27)
MRCNS			81 (6/27)
Propionibacterium spp		4 (1/9)	2 (1/27)
Propionibacterium acnes	12 (1/6)		37 (3/27)
Corynebacterium spp	1 (1/6)	5 (1/9)	15 (3/27)
Branhamella catarrhalis			5 (2/27)
Micrococcus spp			2 (2/27)
Bacillus spp			1 (1/27)
MR *Staphylococcus hamolyticus*	2 (1/6)		1 (1/27)
Moraxella spp		20 (1/9)	
Streptococcus viridans		30 (3/9)	9 (2/27)
Pseudomonas putida			7 (1/27)
Pseudomonas fluorescens			3 (1/27)
MR *Staphylococcus kohnii*			1 (1/27)
Staphylococcus aureus	3 (1/6)		
No pathogen			0 (3/27)

CNS=coagulase-negative staphylococci; MRCNS=meticillin-resistant coagulase-negative staphylococcus; MR=meticillin resistant.

Pathogens isolated from writing tools

Datz, C, *et al.* 1997. What's on doctors' ball point pens? *The Lancet* 350:1824

Personal Products - Phones

43.6% of healthcare workers studied had contamination on their cell phones

Table 1. Type of organisms cultured and number and different locations of HCPs

Organism	Number (%)	Wards	ER	OPD	OR	Total
Staphylococcus aureus	36 (33)	18	7	6	5	36
MRSA	8 (7.3)	2	3		3	8
Staphylococcus epidermidis	25 (22.9)	8	3	12	2	25
Escherichia coli	14 (12.8)	8	3	1	2	14
Pseudomonas aeroginosa	2 (1.8)	0	1	1		2
Acinobacter spp	10 (9.1)	7	1		2	10
Enterococcus spp	10 (9.1)	7	2		1	10
Streptococcus spp	4 (3.7)		1	2	1	4
Total		50	21	22	16	109

ER, emergency room; *MRSA*, methicillin-resistant *Staphylococcus aureus*; *OPD*, out patient department; *OR*, operating room.

Sadat-Ali, M, *et al.* 2010. Bacterial flora on cell phones of health care providers in a teaching institution. *Amer J Infect Control* 38(5):404-405

Personal Products – Keyboards

- 30 keyboards tested – all were contaminated
  - 6 CFU/key to 430 CFU/key
  - Mold found on 22 keyboards
- Pathogens frequently recovered

Messina, G, *et al* 2011. How many bacteria live on the keyboard of your computer? *Amer J Infect Control* 39(7):616-618

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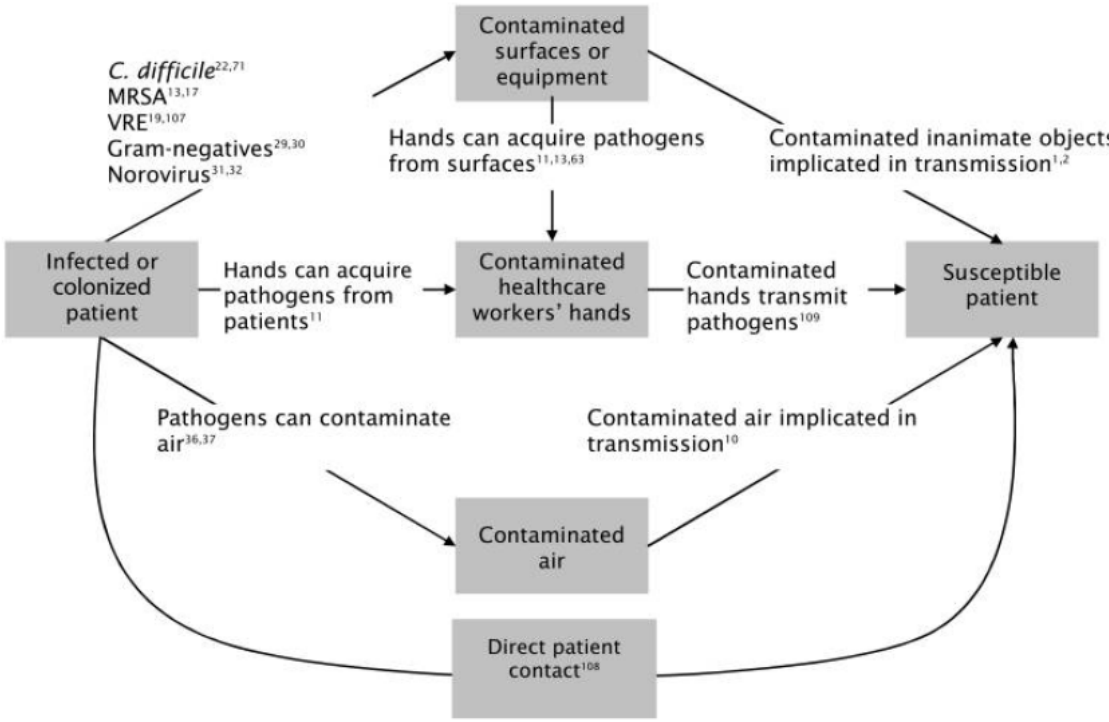

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Assisted Monitoring of Blood Glucose

- Term suggested to distinguish AMBG from self-monitoring of blood glucose
- “Evidence from surveys indicates that unsafe AMBG practices may be more widespread than previously recognized.”
- AMBG must become recognized as a practice similar to but distinct from SMBG in order for diabetes testing products to become labeled as intended for use with SMBG or AMBG.
- Additional safety standards should be established for AMBG, including whether, and under what conditions, specific devices may be used or shared.

Klonoff, DC and JF Perz. 2010. Assisted Monitoring of Blood Glucose: Special Safety Needs for a New Paradigm in Testing Glucose. *J Diabetes Sci Technol* 4(5):1027-1031

Glucose Meters and Cross-contamination

"Use of glucose meters was associated with a high number of opportunities to transmit infections, and those opportunities were reduced only when glucose meters were assigned to individual patients. Recent guidance from the Centers for Disease Control and Prevention and the US Food and Drug Administration to assign glucose meters to individual persons whenever possible is relevant to inpatient care."

Hellinger, WC, *et al* 2011. Glucose meters and opportunities for in-hospital transmission of infection: Quantitative assessment and management with and without patient assignment. *Amer J Infect Control* 39:752-756

CDC Guidance

- "Fingerstick devices should never be used for more than one person
- Whenever possible, blood glucose meters should not be shared. If they must be shared, the device should be cleaned and disinfected after every use, per manufacturer's instructions…how the device should be cleaned and disinfected then it should not be shared.
- Insulin pens and other medication cartridges and syringes are for single-patient-use only and should never be used for more than one person"

CDC. 2011. Infection Prevention during Blood Glucose Monitoring and Insulin Administration. http://www.cdc.gov/injectionsafety/blood-glucose-monitoring.html Accessed 3/11/12

CDC Guidance

"Unused supplies and medications taken to a patient's bedside during fingerstick monitoring or insulin administration should not be used for another patient because of possible inadvertent contamination."

Diabetes and Viral Hepatitis: Important Information on Glucose Monitoring
http://www.cdc.gov/hepatitis/Settings/GlucoseMonitoring.htm#section2
accessed 4/20/12

FDA Guidance

- "Lancing devices should never be used for more than one person. Only auto-disabling, single use lancing devices should be used for assisted blood glucose monitoring in multiple patients.
- Point of care blood testing devices such as blood glucose meters should be used only on one patient and not shared. If dedicating blood glucose meters to a single patient is not possible, the meters must be properly cleaned and disinfected after every use following the guidelines provided in device labeling.
- Healthcare personnel should change gloves between patients, even if patient dedicated testing devices and single-use, self-disabling lancing devices are used."

FDA. 2011. Letter to Manufacturers of Blood Glucose Monitoring Systems Listed With the FDA http://www.fda.gov/MedicalDevices/ProductsandMedicalProcedures/InVitroDiagnostics/ucm227935.htm Accessed 3/11/12

Glucose Test Strips?

- Study looked at contamination in packages of 50 strips (recent switch as cost-saving measure)
- A significant contamination rate observed
- No difference between GTS dedicated to one patient or shared
- Suggested dispensable single units that could be used in a no-touch procedure

Vanhaeren, S, *et al.* 2011. Bacterial contamination of glucose test strips: Not to be neglected. *Amer J Infect Control* 39(7):611-613.

Types of Contamination Seen on Glucose Test Strips

Table 1. Frequencies, nature, and quantitative analysis of bacterial contamination of glucose strip tests: n = 148

Type of ward	Number of positive culture (%)	Number of positive culture with skin flora (%)*	Number of positive culture with enteric flora (%)†	Range of bacterial load for positive strip (UFC/strip)	Mean bacterial load among positive strip (UFC/strip)
SICU	6/36 (16.6)	5/36 (13.9)	1/36 (2.7)	10-20	13
NICU	21/78 (26.9)	21/78 (26.9)	0	10-50	15
HGW	6/20 (30)	5/20 (25)	1/20 (5)	20-280	69
MGW	5/14 (35.7)	5/14 (35.7)	0	10-190	48
Total	38/148 (25.7)	36/148 (24.3)	2/148 (1.4)	10-280	27

GMW, geriatric medicine ward; *HGW*, hepatology and gastroenterology ward; *NICU*, neonatal intensive care unit; *SICU*, surgical intensive care unit.
**Staphylococcus* spp, *Corynebacterium* spp.
†*Enterobacteriaceae*, enterococci.

Vanhaeren, S, *et al.* 2011. Bacterial contamination of glucose test strips: Not to be neglected. *Amer J Infect Control* 39(7):611-613.

Summary

- HAI is a significant problem
- HAI can be reduced by appropriate procedures
- Barriers, procedures, can minimize cross-contamination from healthcare workers to patients
- Case Study: Assisted Monitoring of Blood Glucose

Thank you for your attention

Scott Sutton, Ph.D.