

The Role of Intersectional Innovations in Preventing Infection
Prof. Sanjay Saint, University of Michigan
A Webber Training Teleclass

The Role of Intersectional Innovations in Preventing Infection

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 [@sanjaysaint](https://twitter.com/sanjaysaint)



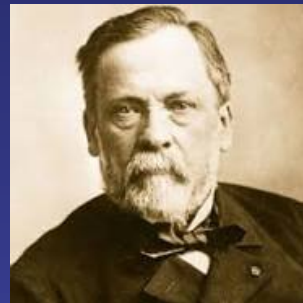
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January 19, 2017

Louis Pasteur
(1822 –1895)



“Chance rewards
the prepared mind.”

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Japan: 1603 to 1868

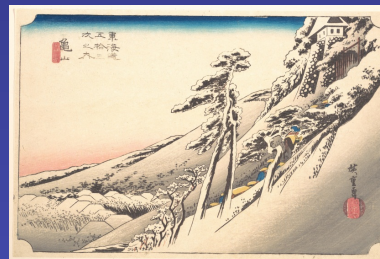
- Japan was shut-off from the outside world except for trade with the Dutch
- Japanese pottery, lacquer ware, and porcelain sent to Rotterdam via ships...



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Wrapped in woodblock prints to prevent damage

Portrayed daily life of common people, landscapes, and Kibuki actors



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TIME

Monet's Love Affair with Japanese Art

By DON MORRISON | PARIS | Thursday, Jan. 04, 2007

“One day...a French artist named Claude Monet walked into a food shop in Amsterdam... There he spotted some Japanese prints being used as wrapping paper. He was so taken by the engravings that he bought one on the spot. The purchase changed his life – and the history of Western Art.”

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Impressionism

Théodore Duret (1838-1927) – A French art critic who promoted Impressionism:

“The appearance...of Japanese prints...initiated us into an absolutely new system. Without the techniques revealed to us by the Japanese a whole methodology would have remained unknown to Western artists”

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Utamaro, K. (1790). *Woman Bathing a Baby in a Tub*. The Metropolitan Museum of Art



Cassat, M. (1891) *The Tub*. The Metropolitan Museum of Art

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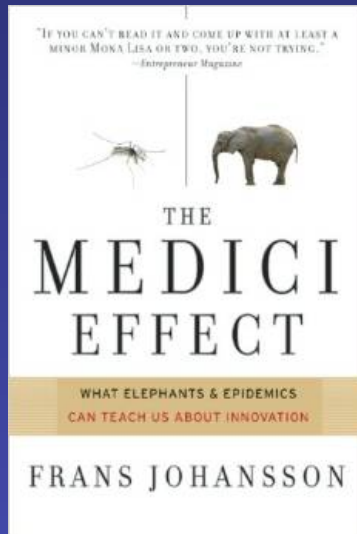
The introduction of Japanese woodblock prints into the French art scene in the mid-19th century is an example of an “intersectional innovation.”

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The Importance of “Intersectional Innovation”



“Diversity drives innovation. Your best chance for ground-breaking innovation is at the intersection where diverse concepts, disciplines, cultures, and industries collide.”

(The Medici Group)

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“The Medicis were a banking family in Florence who funded creators from a wide range of disciplines...sculptors, scientists, poets, philosophers, financiers, painters, and architects converged upon the city of Florence...[which] became the epicenter of a creative explosion...”

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Innovation: Directional vs Intersectional

- Directional innovation = incremental; very common
- Intersectional innovation = game-changer
 - ❖ Surprising and fascinating
 - ❖ Go in new directions and open new fields
 - ❖ Provides source of *directional innovation* for years
 - ❖ Can affect the world in unprecedented ways

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Outline

- ✓ Intersectional Innovation
- Infection Prevention
- Can Intersectional Innovations Help?
- Future Directions



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Healthcare-Associated Infections: Common, Costly, & Harmful

5 to 10% of hospitalized
patients develop an infection

- Half of infections are preventable
- Preventive practices used inconsistently

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Catheter-Associated Urinary Tract Infection (CAUTI)

- One of the most common infections
- 1/4 of inpatients receive catheters
- 1/3 of catheter days unnecessary
- 1/3 of physicians unaware their patient has a catheter
- 1/3 of the time no order for a catheter

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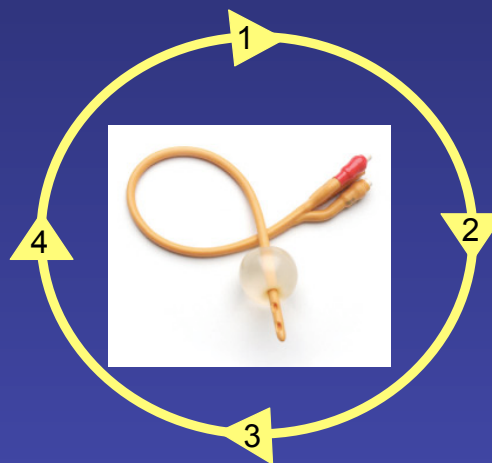
How can we reduce catheter use and prevent CAUTI?

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Disrupting the Lifecycle of the Urinary Catheter

1. Preventing Unnecessary and Improper Placement

4. Preventing Catheter Replacement



2. Maintaining Awareness & Proper Care of Catheters

3. Prompting Catheter Removal

(Meddings & Saint. Clin Infect Dis 2011)

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The **NEW ENGLAND**
JOURNAL of MEDICINE

ESTABLISHED IN 1812

JUNE 2, 2016

VOL. 374 NO. 22

**A Program to Prevent Catheter-Associated Urinary Tract
Infection in Acute Care**

Sanjay Saint, M.D., M.P.H., M. Todd Greene, Ph.D., M.P.H., Sarah L. Krein, Ph.D., R.N., Mary A.M. Rogers, Ph.D.,
David Ratz, M.S., Karen E. Fowler, M.P.H., Barbara S. Edson, R.N., M.B.A., M.H.A.,
Sam R. Watson, M.S.A., C.P.P.S., Barbara Meyer-Lucas, M.D., M.H.S.A., Marie Masuga, R.N., M.S.N.,
Kelly Faulkner, M.S.P.A., Carolyn V. Gould, M.D., M.S.C.R., James Battles, Ph.D.,
and Mohamad G. Fakih, M.D., M.P.H.

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Preventing CAUTI in Acute Care

(Saint et al. N Engl J Med 2016)

- Federally-funded national program in the U.S.
- Total of 603 hospitals (926 units) in 32 states
- ~60% non-ICU; ~40% ICU
- Non-ICUs: CAUTI reduced by 32% (& decrease in catheter use)
- ICUs: no change in CAUTI or catheter use

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The *key* intervention is having the bedside nurse assess daily whether the catheter is necessary.

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Q: What is the best way to prevent any type of hospital infection?



Answer: Hand Hygiene

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Hand Hygiene Compliance in Healthcare Workers

(Erasmus et al. Infect Control Hosp Epidemiol March 2010)

- Systematic review of 96 studies
- Overall median compliance of 40%
- Lower rates in physicians (32%) than nurses (48%)
- Lower rates “before” (21%) patient contact rather than “after” (47%)

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Tuscan-American Safety Collaborative (TASC)

- Sabbatical to the U of Florence: Sept 2007 to June 2008
- Studied diffusion of innovation within a centralized system of healthcare
- Italy's health system ranked #2 by W.H.O.



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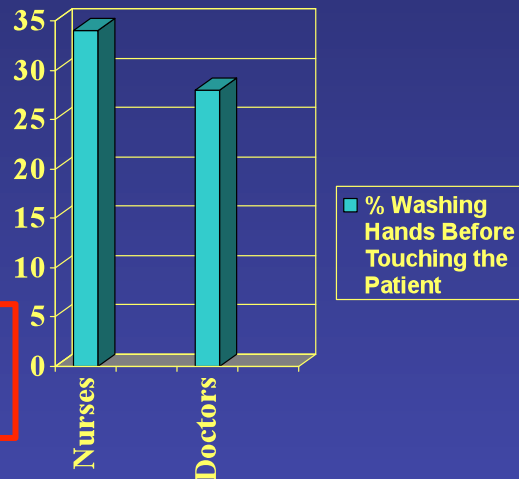
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Hand Hygiene Adherence: 5 Unit Interventional Study in Florence

Pre-intervention observations:

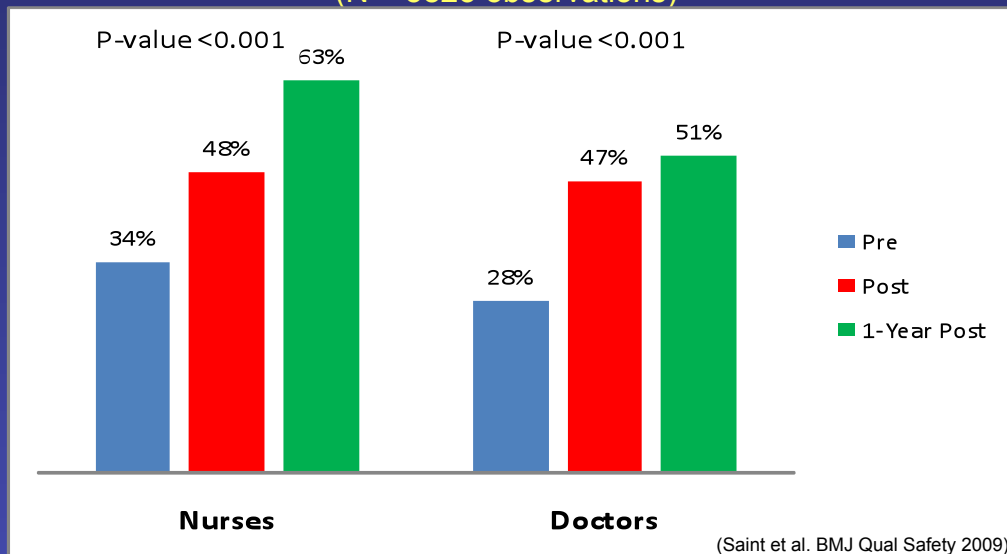
- 6 nursing students (and me) were external observers
- 1147 nurse-pt observations
- 665 doctor-pt observations
- Nurses: 34% washed hands
- Doctors: 28% washed hands



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Hand Hygiene Prior to Touching the Patient: Overall Results on 5 Units

(N = 5823 observations)



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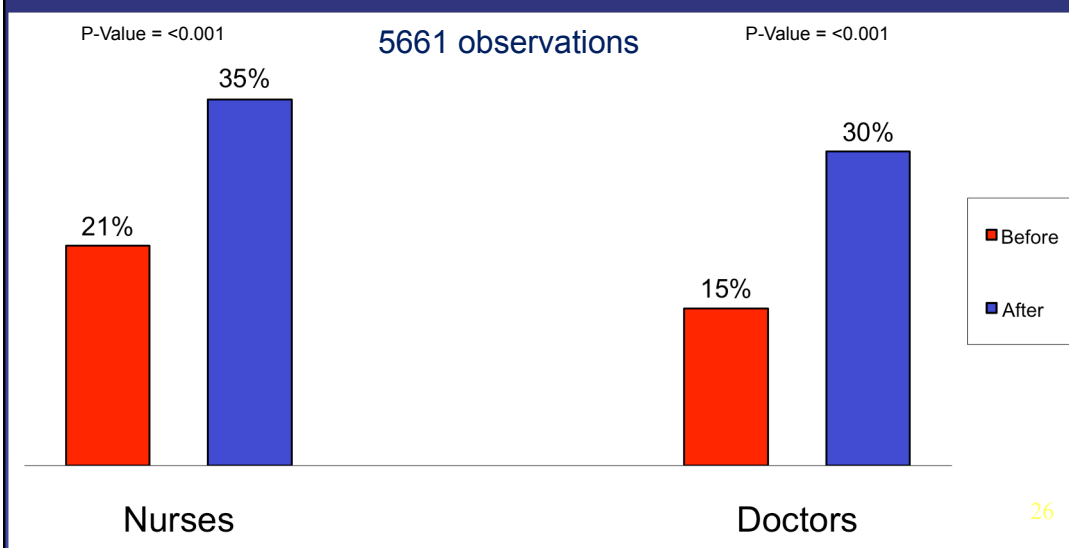
Hand Hygiene Adherence: 4 Hospital Study in Japan



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Hand Hygiene Prior to Touching the Patient: Overall Results in Japan

(Sakihama et al. J Hospital Med 2015)



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Preventing infection is both simple – get the catheter out and wash your hands! – and complex: changing behavior.

Can intersectional innovations help?

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The 1st intersectional innovation to consider is human factors engineering

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Human Factors Engineering

- The study of how humans interact with technology and the effect technology has on human behavior
- A few examples...

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Utilizing Human Factors Engineering in Infection Prevention

American Journal of Infection Control 43 (2015) 241-7

Contents lists available at [ScienceDirect](#)

 **ELSEVIER**

American Journal of Infection Control

journal homepage: www.ajicjournal.org

 **AJIC**
American Journal of Infection Control

Major article

Understanding the current state of infection prevention to prevent *Clostridium difficile* infection: A human factors and systems engineering approach 

Eric Yanke MD^a, Caroline Zellmer^b, Sarah Van Hoof BSN, RN^c,
Helene Moriarty PhD, RN^{d,e}, Pascale Carayon PhD^f, Nasia Safdar MD, PhD^{g,h,i,*}

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October 2013 | ergonomics in design

Adherence Engineering: A New Approach to Increasing Adherence to Protocols

Frank Drews, PhD

Prevention of serious infection through application of AE principles to central-line dressing is one of many examples of how this new concept can improve task performance.

feature | Adherence Engineering: A New Approach to Increasing Adherence to Protocols

October 2013 | ergonomics in design



Figure 3. Layout of the newly developed, sequential central-line dressing maintenance kit illustrating label use.

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Journal of Hospital Infection 89 (2015) 335–339

Available online at www.sciencedirect.com



Journal of Hospital Infection

journal homepage: www.elsevierhealth.com/journals/jhin



Mental models: a basic concept for human factors design in infection prevention

H. Sax*, L. Clack

HAL 14, Division of Infectious Diseases and Infection Control, University Hospital Zurich, Raemistrasse 100, 8091 Zurich, Switzerland

S U M M A R Y

Much of the effort devoted to promoting better hand hygiene is based on the belief that poor hand hygiene reflects poor motivation. We argue, however, that automatic unconscious behaviour driven by 'mental models' is an important contributor to what actually happens. Mental models are concepts of reality – imaginary, often blurred, and sometimes unstable. Human beings use them to reduce mental load and free up capacity in the conscious mind to focus on deliberate activities. They are pragmatic solutions to the complexity of life. Knowledge of such mental processes helps healthcare designers and

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A 2nd intersectional innovation is understanding the powerful role both leaders and followers have in implementing & sustaining change.

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Leadership: Definitions

- Leadership is “a process whereby an individual influences a group of individuals to achieve a common goal”
(Northouse in “Leadership: Theory and Practice” 2010)
- “Assigned” leadership = leadership that is based on occupying a position in an organization
- “Emergent” leadership = leadership that emerges from an influential member of a group regardless of the person’s title or position

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Leadership Research: Transactional vs Transformational

Transactional:

- Transaction (or exchange) of something leader has that the follower wants
- Specifies roles and tasks
- Reward & punishment used as motivation
- “One-size-fits-all”

Transformational:

- Inspires followers to see beyond their self-interest
- Adapts to the needs and motives of followers
- Behaves in a way that engenders great trust
- The leader often relies on charisma

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“The culture of any hospital is dictated by the *worst* behavior the leader tolerates.”

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Question: What is the Secret to
Good Leadership?

Good Followership



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Followership

- Follower: “a person who accepts the leadership of another”
- An understudied area: Book search on Amazon revealed...
 - >95,000 titles on leadership
 - ~800 titles on followership (mostly spiritual or political)
 - 120:1 in favor of leadership
- Unfortunate asymmetry since leadership and followership are intertwined
- Most leaders are also followers!

(Kelley, Harvard Business Review, 1988)

Followership: 5 Key Types

(Kelley: The Power of Followership, 1992)

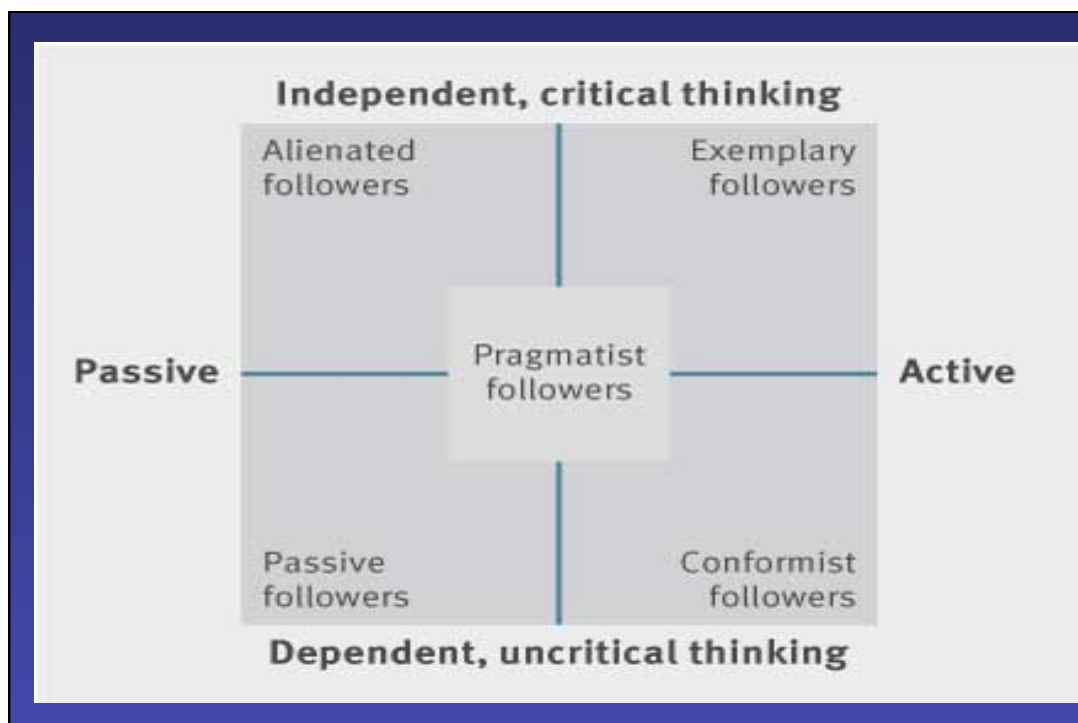
- Alienated: mavericks with a healthy skepticism of the organization; capable but highly cynical
- Conformists: the “yes people” of the organization; limited independent thinking; often seen in rigid bureaucracies
- Passive: require disproportionate supervision relative to their contribution; lack initiative and sense of responsibility
- Pragmatists: hug the middle of the road; will do a good job but won't stick their necks out
- Exemplary followers: independent, innovative, and willing to question leadership; critical to organizational success

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What Type of Followers are Infection Preventionists?

- Lead infection preventionists from national sample of U.S. hospitals
- Response rate 71% (403/571)
- Robert Kelley *The Power of Followership*
- 5 styles of followers
- Linked followership style to infection prevention practices

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Sample Questions

- Are you highly energized by your work?
- Do you take initiative to seek out assignments that go above and beyond your job?
- When you are not the leader of a group do you often do more than your share?
- Do you independently think up and champion new ideas?
- Do you assert your views on important issues, even though your supervisor may disagree?

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What Type of Followers are Infection Preventionists?

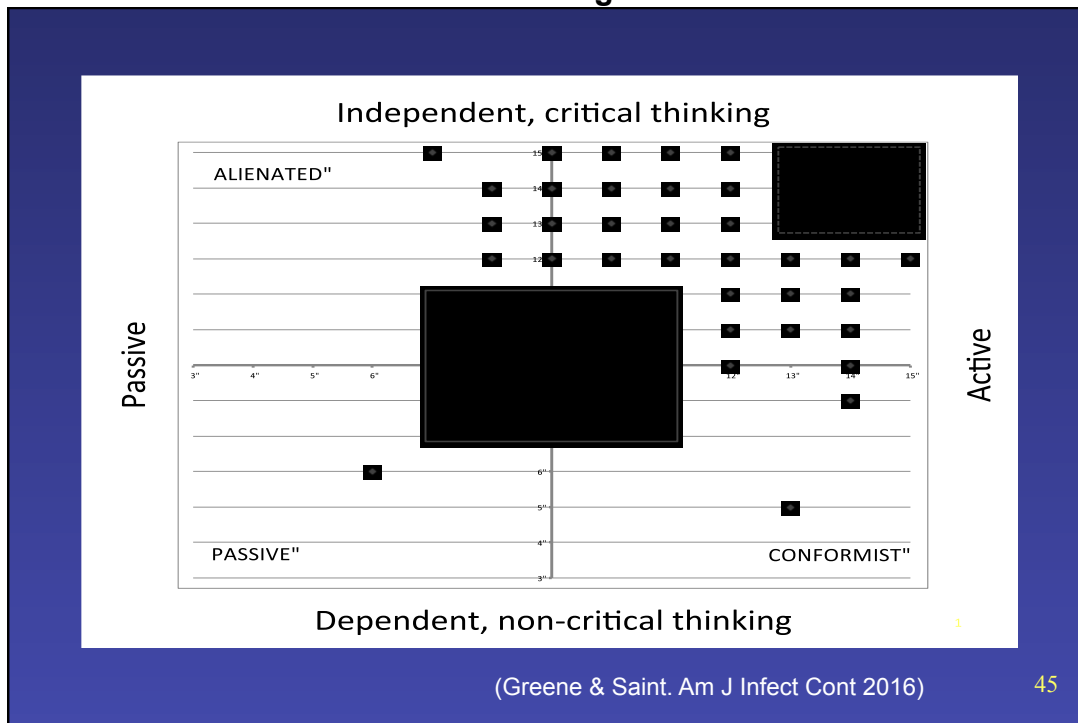
- Exemplary = ~74%
- Pragmatist = ~18%
- Conformist = <3%
- Alienated = <3%
- Passive = <1%

(Greene & Saint. Am J Infect Cont 2016)

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Regular Use of Select Prevention Practices

- CAUTI
 - Catheter reminder/nurse discontinuation = 64%
- CLABSI
 - Antimicrobial dressing with chlorhexidine = 79%
- VAP
 - Subglottic secretion drainage = 56%
- General
 - Chlorhexidine cleansing cloth = 46%

(Greene & Saint. Am J Infect Cont 2016)

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Truly Exemplary Followership & Prevention Practices

- CAUTI
 - Catheter reminder/nurse-initiated discontinuation
 - OR = 3.19 (1.69 – 6.01), $p < 0.001$
- CLABSI
 - Antimicrobial dressing with chlorhexidine (Biopatch™)
 - OR = 1.12 (0.59 – 2.13), $p = 0.74$
- VAP
 - Subglottic secretion drainage via special endotracheal tube
 - OR = 1.72 (1.01 – 2.93), $p = 0.04$
- General
 - Chlorhexidine cleansing cloth
 - OR = 1.60 (0.97 -2.64), $p = 0.07$

(Greene & Saint. Am J Infect Cont 2016)

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Take away

Intriguing preliminary findings suggesting that truly exemplary followership associated with increased use of certain infection prevention practices (e.g., urinary catheter removal)

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*The final intersectional innovation
is to engage the senses.*

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biology
letters

Biol. Lett. (2006) 2, 412–414

doi:10.1098/rsbl.2006.0509

Published online 27 June 2006

Cues of being watched enhance cooperation in a real-world setting

Melissa Bateson*, Daniel Nettle
and Gilbert Roberts

*Evolution and Behaviour Research Group, School of Biology and
Psychology, University of Newcastle upon Tyne, Henry Wellcome
Building for Neuroecology, Framlington Place, Newcastle upon Tyne
NE2 4HH, UK*

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Cues of being watched...

(Bateson et al. *Biology letters* 2.3 (2006): 412-414.)

- 48 participants had the option to pay for tea, coffee and milk via an honesty box
- A notice displayed above the box with an image that alternated weekly between a pair of eyes & flowers
- 10-week study
- Compared the total amount of money collected in the honesty box per week

(Slide courtesy of H Sax)

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Engaging the Senses: Smell

Journal of Hospital Infection 85 (2013) 79–81



Available online at www.sciencedirect.com

Journal of Hospital Infection

journal homepage: www.elsevierhealth.com/journals/jhin



Short report

Impact of environmental olfactory cues on hand hygiene behaviour in a simulated hospital environment: a randomized study

D.J. Birnbach^{a,*}, D. King^b, I. Vlaev^b, L.F. Rosen^a, P.D. Harvey^c

^aUM-JMH Center for Patient Safety, University of Miami Miller School of Medicine, Miami, FL, USA

^bCentre for Health Policy, Imperial College London, St Mary's Hospital, London, UK

^cDepartment of Psychiatry, University of Miami Miller School of Medicine, Miami, FL, USA

Impact of environmental olfactory cues on hand hygiene behavior...

(Birnbach, et al. Journal of Hospital Infection. 2013)

- 165 students/interns examined a standardized patient
- Randomly assigned to two groups:
 - 79 exposed to a fresh-smelling environment (citrus)
 - 86 exposed to a standardized smell
- Focus was on hand hygiene prior to touching the patient

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Impact of environmental olfactory cues on hand hygiene behavior...

(Birnbach, et al. Journal of Hospital Infection. 2013)



Results:

– Fresh scent (citrus) hand hygiene compliance: 80%

– Standard scent hand hygiene compliance: 51%

– P-value: <0.001



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Health Psychology

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0278-6133/15/\$12.00 <http://dx.doi.org/10.1037/hea0000239>

BRIEF REPORT

“Priming” Hand Hygiene Compliance in Clinical Environments

Dominic King
Imperial College London

Ivo Vlaev
University of Warwick

Ruth Everett-Thomas and Maureen Fitzpatrick
University of Miami Miller School of Medicine

Ara Darzi
Imperial College London

David J. Birnbach
University of Miami Miller School of Medicine

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“Priming” Hand Hygiene Compliance in...
(King et al. Health Psychology 2015)

- Randomized trial in a surgical ICU of hand hygiene before entering patient room; direct observation
- Evaluated whether priming via olfactory (citrus smell) or visual (eyes) cues affects compliance
- 120 controls, 160 in the olfactory intervention, 124 in the visual intervention

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“Priming” Hand Hygiene Compliance in...
(King et al. Health Psychology 2015)

- A clean citrus smell: 15% to 47% ($p=0.001$)
- A picture of “male eyes” above hand gel dispensers: 15% to 33% ($p=0.038$)
- A picture of “female eyes”: 15% to 10% ($p=0.6$)

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“Priming” Hand Hygiene Compliance in...
(King et al. Health Psychology 2016)



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Outline

- Intersectional Innovation
- Infection Prevention
- Can Intersectional Innovations Help?
- **Future Directions**



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Future Directions

- Preventing hospital infection is important
- CAUTI is a prototypical patient safety problem: preventing infection is both simple and complex
- Human factors engineering, leadership, followership & engaging the senses may help
- The final frontier is...

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Engaging the Mind

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“the awareness that arises by paying attention on purpose, in the present moment...”



(Gilmartin. BMJ 2016)

Applying Mindfulness to Prevent CAUTI

(Kiyoshi-Teo et al. Infect Cont Hosp Epid 2013)

A 2-second “pause” before inserting a Foley...

Is the Foley truly needed?

Am I using proper technique?

Do I need to ask for help?

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Most importantly,

**Preventing Infection
is a Team Sport!**

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Thank you!



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www.webbertraining.com/schedulepl.php	
26 Jan. 17	<p>HEATER-COOLER UNIT ASSOCIATED <i>MYCOBACTERIUM CHIMAERA</i> INFECTIONS: AN OUTBREAK IN SLOW MOTION</p> <p>Speaker: Prof. Michael Edmond, University of Iowa Hospitals & Clinics</p> <p><i>(FREE Teleclass)</i></p>
02 Feb. 17	<p>KNOWLEDGE GAP ABOUT EBOLA VIRUS DISEASE AMONG HEALTH WORKERS IN HOTSPOTS IN SUDAN</p> <p>Speaker: Musaab Mohamed Nour Abdelrahim Alfaki, Daoud Research Group and Charity Clinic, Sudan</p> <p><i>(South Pacific Teleclass)</i></p>
22 Feb. 17	<p>CATHETER-ASSOCIATED URINARY TRACT INFECTION PREVENTION IN THE CONTINUUM OF ACUTE CARE</p> <p>Speaker: Jan Gralton, Australian Commission on Safety and Quality in Healthcare</p>
23 Feb. 17	<p>USING EXPERT PROCESS TO COMBAT <i>CLOSTRIDIUM DIFFICILE</i> INFECTIONS</p> <p>Speaker: Isabelle Guerreiro and Camille Achonu, Public Health Ontario, Canada</p> <p><i>(European Teleclass)</i></p>
28 Feb. 17	<p>THE ROLE OF DRY SURFACE CONTAMINATION IN HEALTHCARE INFECTION TRANSMISSION</p> <p>Speaker: Prof. Jon Otter, Imperial College Healthcare NHS Trust, London</p>
09 Mar. 17	<p>EVALUATION OF INFECTION CONTROL TRAINING</p> <p>Speaker: Martin Kiernan, University of West London</p>

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