The Role of Intersectional Innovations in Preventing Infection
Sanjay Saint, MD, MPH
Chief of Medicine, VA Ann Arbor Healthcare System
George Dock Professor, University of Michigan
@sanjaysaint

Hosted by Dr. Hugo Sax
University of Zurich Hospitals

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Louis Pasteur
(1822 –1895)

“Chance rewards the prepared mind.”
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…

Wrapped in woodblock prints to prevent damage

Portrayed daily life of common people, landscapes, and Kibuki actors
“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.”

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

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

(The Medici Group)

“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

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

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
How can we reduce catheter use and prevent CAUTI?

Disrupting the Lifecycle of the Urinary Catheter

1. Preventing Unnecessary and Improper Placement
2. Maintaining Awareness & Proper Care of Catheters
3. Promoting Catheter Removal
4. Preventing Catheter Replacement

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

Preventing CAUTI in Acute Care

- 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.

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

Answer: Hand Hygiene
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%)

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.
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

Hand Hygiene Prior to Touching the Patient: Overall Results on 5 Units (N = 5823 observations)

P-value < 0.001

(N = 5823 observations)

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Hand Hygiene Adherence: 4 Hospital Study in Japan

Hand Hygiene Prior to Touching the Patient: Overall Results in Japan
(Sakihama et al. J Hospital Med 2015)

- P-Value = <0.001
- 5661 observations

- Nurses: Before = 21%, After = 35%
- Doctors: Before = 15%, After = 30%
Preventing infection is both simple – get the catheter out and wash your hands! – and complex: changing behavior.

Can intersectional innovations help?

The 1st intersectional innovation to consider is human factors engineering.
Human Factors Engineering

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

- A few examples…

Utilizing Human Factors Engineering in Infection Prevention

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

Eric Yanke MD,*, Caroline Zellmer ‡, Sarah Van Hoof BSN, RN ‡, Helene Moriarty PhD, RN §, Pascale Carayon PhD ‡, Nasia Safdar MD, PhD ‡,§,⊥,⊥⊥
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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.

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

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, Rämistrasse 100, 8091 Zurich, Switzerland

SUMMARY
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.

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
### Leadership Research: Transactional vs Transformational

<table>
<thead>
<tr>
<th>Transactional:</th>
<th>Transformational:</th>
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<tbody>
<tr>
<td>• Transaction (or exchange) of something leader has that the follower wants</td>
<td>• Inspires followers to see beyond their self-interest</td>
</tr>
<tr>
<td>• Specifies roles and tasks</td>
<td>• Adapts to the needs and motives of followers</td>
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<tr>
<td>• Reward &amp; punishment used as motivation</td>
<td>• Behaves in a way that engenders great trust</td>
</tr>
<tr>
<td>• “One-size-fits-all”</td>
<td>• The leader often relies on charisma</td>
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“The culture of any hospital is dictated by the worst behavior the leader tolerates.”
Question: What is the Secret to Good Leadership?

Good Followership
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
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?

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%
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)

Take away

Intriguing preliminary findings suggesting that truly exemplary followership associated with increased use of certain infection prevention practices (e.g., urinary catheter removal)
The final intersectional innovation is to engage the senses.
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

People paid 3X as much for their drinks when eyes were displayed rather than a control image

(Slide courtesy of H Sax)
Engaging the Senses: Smell

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

D.J. Birnbach, D. King, I. Vlaev, L.F. Rosen, P.D. Harvey

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

BRIEF REPORT

“Priming” Hand Hygiene Compliance in Clinical Environments

Dominic King
Imperial College London

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

Ivo Vlaev
University of Warwick

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

“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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• 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…

Engaging the Mind
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!

Thank you!

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26 Jan. 17
HEATER-COOLER UNIT ASSOCIATED MYCOBACTERIUM CHIMAERA INFECTIONS: AN OUTBREAK IN SLOW MOTION
Speaker: Prof. Michael Edmond, University of Iowa Hospitals & Clinics

02 Feb. 17
KNOWLEDGE GAP ABOUT EBOLA VIRUS DISEASE AMONG HEALTH WORKERS IN HOTSPOTS IN SUDAN
Speaker: Musaab Mohamed Nour Abdelrahim Alfaki, Daoud Research Group and Charity Clinic, Sudan

22 Feb. 17
CATHETER-ASSOCIATED URINARY TRACT INFECTION PREVENTION IN THE CONTINUUM OF ACUTE CARE
Speaker: Jan Gralton, Australian Commission on Safety and Quality in Healthcare

23 Feb. 17
USING EXPERT PROCESS TO COMBAT CLOSTRIDIUM DIFFICILE INFECTIONS
Speaker: Isabelle Guerreiro and Camille Achonu, Public Health Ontario, Canada

28 Feb. 17
THE ROLE OF DRY SURFACE CONTAMINATION IN HEALTHCARE INFECTION TRANSMISSION
Speaker: Prof. Jon Otter, Imperial College Healthcare NHS Trust, London

09 Mar. 17
EVALUATION OF INFECTION CONTROL TRAINING
Speaker: Martin Kiernan, University of West London

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