

Hand Hygiene: A Resident Safety Imperative—Madison, WI—October 15, 2019

## APPLICATION OF HUMAN FACTORS/SYSTEMS ENGINEERING TO HAND HYGIENE PROMOTION

JACKSON MUSULUZA, MBBS, MPH, PHD, RESEARCHER  
MARY JO KNOBLOCH, PHD, MPH, RESEARCHER  
ROSIE BARTEL, PATIENT ADVISOR AND ADVOCATE

DIVISION OF INFECTIOUS DISEASES, DEPARTMENT OF MEDICINE  
UNIVERSITY OF WISCONSIN SCHOOL OF MEDICINE AND PUBLIC HEALTH

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## DISCLOSURES

- None

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## OBJECTIVES

- To describe what human factors means in the context of health care
- To describe the role of human factors engineering (HFE) methods in designing hand hygiene (HH) initiatives
- To present a patient perspective about HH
- To provide practical tools that can support HH initiatives and improve compliance

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### HUMAN FACTORS: CONSIDERING THE ENTIRE SYSTEM



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### PATIENT SAFETY AND HH: TWO IOM REPORTS

- 1999: *To Err Is Human: Building a Safer Health Care System*
  - Over 90,000 Americans dying due medical errors each year
- 2001: *Crossing the Quality Chasm: Health Care in the 21<sup>st</sup> Century (the 6 dimensions)*:
  - Safe: "First, do no harm" How to avoid injuries from care intended to help
    - Hand hygiene
  - Effective: match science, with neither underuse nor overuse
  - Patient-centered: "Nothing about me without me"
  - Timely: Unintended waiting
  - Efficient: Constantly seeking to reduce the waste
  - Equitable: Quality care regardless of race, ethnicity, gender, income

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### PATIENT SAFETY AND HH

- "Crossing the Quality Chasm" emphasized the need to improve the design of health care systems and processes for patient safety
- Information provision alone does not improve HH compliance: need for multimodal approaches
- Human behavior and infection prevention are tightly linked
  - HH is the most important single behavior that healthcare workers (HCWs) can engage in to protect patients from infection
- Focus beyond individuals, rather design/redesign work areas to facilitate HH

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### WHAT IS HUMAN FACTORS ENGINEERING (HFE)?

- The study of how humans interact physically and cognitively with the world around them, including environments, tools, processes, and procedures. It is “matching” the work system to the “person”
- HFE seeks to optimize the interactions among humans and other system elements

International Ergonomics Society, 2000

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### HFE HAS LONG BEEN RECOGNIZED IN OTHER FIELDS

- Aerospace systems
- The nuclear industry
- Ground transportation

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### WHY DO WE NEED HFE IN THE HEALTH CARE INDUSTRY?

- HFE provides principles, tools, and techniques for:
  - Systematically identifying important factors within the system
  - Analyzing and evaluating how these factors interact to influence risk of healthcare-associated infections (HAIs)
  - Identifying and implementing effective preventive measures
- HFE helps make HH intuitive, efficient, and sustainable
  - Healthcare institutions need organizational structures that support necessary collaboration between HCWs and HFE experts

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Curr Treat Options Infect Dis (2017) 9:230–249  
 DOI 10.1007/s40506-017-0123-y  
**New Technologies and Advances in Infection Prevention (AR Marra, Section Editor)**

### Role of Human Factors Engineering in Infection Prevention: Gaps and Opportunities

*Priyadarshini R. Pennathur, PhD<sup>1,\*</sup>  
 Loreen A. Herwaldt, MD<sup>2</sup>*

- Limited use and application of formal HFE tools and methods in HH studies
- Only a few HH studies formally assess all components in a system
- Addressing the latent and deep-rooted human factors problems requires assessment of the interaction of critical system components

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### CONCEPTUAL APPROACHES TO PATIENT SAFETY

- In the past there has been emphasis on individual responsibility
  - provide high-quality patient care
  - avoid adverse events through error-free practice
- Assumes infallibility of HCWs—unrealistic and unsafe
- Systems emphasis has shown success
- Latent conditions (blunt end): “resident pathogens” within the system
  - arise from decisions made by managers, engineers, designers and others
- Active failures (sharp end)—direct actions/behaviors resulting in failure
  - violations or workarounds (e.g., deliberate failure to perform HH)

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### CONCEPTUAL APPROACHES TO PATIENT SAFETY

- Swiss cheese model

The diagram illustrates the Swiss cheese model of patient safety. It shows four slices of Swiss cheese, each with a hole. The holes are aligned to form a path leading to a 'Patient Safety Incident'. The holes are labeled as 'ACTIVE ERRORS'. The spaces between the slices are labeled as 'Levels of defence'. To the right, a text box defines 'LATENT CONDITIONS: poor design, procedures, management decisions etc.'.

- Systems Engineering Initiative for Patient Safety (SEIPS) model
  - 5 elements of the work system: *Tools & technologies, Organization, Person, Tasks, Environment*
  - Non-linear & integrates many aspects of other models

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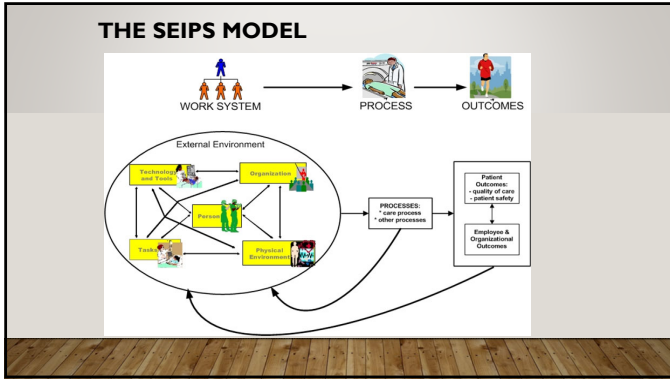
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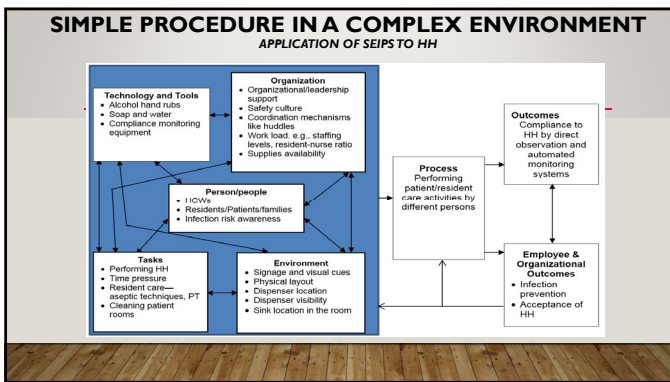
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## THE PATIENT JOURNEY: HUMAN FACTORS FROM A PATIENT PERSPECTIVE

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Rosie Bartel, Patient Advisor and Advocate  
 bartel1949@gmail.com

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# REVIEW OF EVIDENCE: EXAMPLES OF HOW HFE PROMOTED HH COMPLIANCE

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American Journal of Infection Control 43 (2015) 387-9

Contents lists available at ScienceDirect

**American Journal of Infection Control**

journal homepage: www.ajicjournal.org

ELSEVIER

American Journal of Infection Control

Brief report

**Impact of sink location on hand hygiene compliance for *Clostridium difficile* infection**

Caroline Zellmer<sup>a</sup>, Rebekah Blakney BS<sup>1</sup>, Sarah Van Hoof BSN, RN<sup>a</sup>, Nasia Safdar MD, PhD<sup>a,b,\*</sup>

<sup>a</sup>Section of Infectious Diseases, Department of Medicine, University of Wisconsin, Madison, WI

<sup>b</sup>William S. Middleton Veterans Hospital, Madison, WI

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## OBJECTIVE AND METHODS

**Objective:** Evaluate the relationship between sink location and compliance with handwashing among HCWs and visitors

**Setting:** Surgical transplant unit

**Methods:**

- Readily visible accessible sink identified as a major barrier during initial assessment
- 2 additional sinks were placed in highly visible locations on the unit
  - Foot pedals and adequate supplies
- Optimal location of sinks selected through collaboration between engineering, facilities planning, infection control, and unit staff
- Covert observers

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**RESULTS: IMPACT OF SINK LOCATION ON HH**

Compliance	Pre-intervention	Post-intervention	P value
No HH before	72.5 (58/80)	51.6 (32/62)	.0104
No HH after	54.6 (42/77)	37.1 (23/62)	.0404
Soap and water after	33.8 (26/77)	51.6 (32/62)	.0339
Alcohol gel before	27.5 (22/80)	48.4 (30/62)	.0104

*"Staff reported that the 2 new visible sinks enhanced the likelihood of completing proper hand hygiene."*

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**THE LANCET**  
 Volume 356, Issue 9238, 14 October 2000, Pages 1307-1312

Articles

**Effectiveness of a hospital-wide programme to improve compliance with hand hygiene**

Prof Didier Pittet MD<sup>a</sup>, Stéphane Hugonnet MD<sup>a</sup>, Stephan Harbarth MD<sup>a</sup>, Philippe Mourouga MD<sup>a</sup>, Valérie Sauvan RN<sup>a</sup>, Sylvie Touveneau RN<sup>a</sup>, Thomas V Perneger MD<sup>b</sup>, members of the Infection Control Programme

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**INTERVENTION**

- Multimodal HH intervention
- Strategically-displayed & collaboratively-designed posters (Visibility)
- Performance feedback (Error prevention)
- Distribution of individual hand sanitizer (Flexibility & Efficiency)
- Alcohol hand-rub dispensers mounted to patient beds (Accessibility & Consistency)
- Institutional support (Context)

Pittet et al. 2000

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## RESULTS

- Overall HH compliance improved significantly over a 3-year period from 47.6% to 66.2% ( $p < 0.001$ )
- Prevalence of HAIs decreased from 16.9% to 9.9% ( $p = 0.04$ )
- Overall incidence of MRSA decreased from 2.16 to 0.93 episodes per 10,000 patient days ( $p < 0.001$ ) over a 4 year period

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## CONCLUSIONS

- Improving HCW compliance to a complex behavioral intervention, such as HH requires a systems assessment and designing of interventions that reduce systems barriers to HH
- Being intentional about applying HFE principles to designing HH interventions improves patient outcomes

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## REFERENCES

1. Canadian Patient Safety Institute. Hand Hygiene Human Factors Toolkit. <https://www.patientsafetyinstitute.ca/en/toolsResources/pages/human-factors-toolkit.aspx>. Accessed September 27, 2019.
2. Carayon P. *Handbook of Human Factors and Ergonomics in Health Care and Patient Safety*. CRC Press 2017.
3. Carayon P, Wetterneck TB, Rivera-Rodriguez AJ, et al. Human factors systems approach to healthcare quality and patient safety. *Appl Ergon* 2014;45:14-25.
4. Pittet D, Boyce JM, Allegranzi B. *Hand Hygiene: A Handbook for Medical Professionals*. Wiley; 2017.
5. Pennathur PR, Herwaldt LA. Role of Human Factors Engineering in Infection Prevention: Gaps and Opportunities. *Current Treatment Options in Infectious Diseases*. 2017;9:230-249.
6. Reason J. Human error: Models and management. *BMJ*. 2000;320(7237):768-770. [PubMed:10720363].
7. Pittet D, et al. Effectiveness of a hospital-wide programme to improve compliance with hand hygiene. *Infection Control Programme Lancet*. 2000;356(9238):1307-1312.
8. Zellmer C, Blakney R, Van Hoof S, Safdar N. Impact of sink location on hand hygiene compliance for Clostridium difficile infection. *Am J Infect Control* 2015;43:387-389.

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## THANK YOU FOR LISTENING TO ME

Jackson Musuuza, MBBS, MPH, PhD  
[musuuzaj@wisc.edu](mailto:musuuzaj@wisc.edu)

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## SUSTAINING EVIDENCE-BASED HAND HYGIENE PRACTICES

*PRACTICAL TOOLS YOU CAN USE*

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## IT'S TIME TO MIND THE GAP!



- Evidence-based guidelines
- Educational Tools
  - Centers for Disease Control and Prevention (CDC)
    - HH 101: Core Concepts of Hand Hygiene: Clean Hands or Health Care Personnel
    - HH 102: Hand Hygiene: Education, Monitoring and Feedback
    - HH 103: Identifying Motivators for Hand Hygiene: External and Internal Factors
  - WHO Guidelines on Hand Hygiene in Health care, WHO 2009

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**LEADERSHIP ROUNDS**

ONETOOL YOU CAN USE!




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**HAI LEADERSHIP ROUNDS (WALK ROUNDS)**

- Leadership Rounds
  - A quality improvement tool that connects leaders with frontline staff
- Leaders meet with staff – where the work is done
- Leadership understands the value stream; tapping into experience of frontline employees to solve problems
- Institute for Healthcare Improvement (IHI)
  - Managing by walking around (Gemba Walks)
  - Stresses in-person communication

*Knobloch MJ et al. Am J Infect Control. 2018 Mar;46(3):303-310*

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**STUDY OF LEADERSHIP ROUNDS (HAI)**

<p><b>COMMUNICATION</b></p> <ul style="list-style-type: none"> <li>• Much interaction between staff and leaders</li> <li>• Staff talked freely about mistakes</li> <li>• Staff and leader/s problem-solved often</li> </ul>	<p><b>STRUCTURE</b></p> <ul style="list-style-type: none"> <li>• Conducted on 19 units in cycles</li> <li>• Every 3 months</li> <li>• Time of day is flexible</li> <li>• 30 minutes in duration</li> <li>• Flexible location</li> <li>• Flexible agenda – and modified as needed</li> </ul>
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### KEY THEMES

- **Learning Climate**
  - An environment that enhances psychological safety (reflection and evaluation time)
- **Psychological safety**
  - Staff feel they are respected and knowledgeable partners, can test new ideas or methods




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### WHAT DO WE KNOW?

- Leaders can influence learning climate which, in turn, can influence psychological safety
- Psychological safety can lead to workers speaking up
- Evidence supports the link between psychological safety and quality improvement
- Evidence supports Leadership Rounds as a successful tool for patient safety

A. Edmondson, 2014; Aranzamendez, James, & Tims, 2015; A. C. Edmondson, 1999; Zhou & Pan, 2015; Aarons, Ehrhart, Farahnak, Sklar, & Horwitz, 2015; Lindstrom, 2013; McCormack et al., 2002; McFadden, Stock, & Gaven, 2014; Saint, Kawalski, et al., 2010; A. Frankel et al., 2003; A. Frankel et al., 2005; A. Frankel et al., 2008

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### SUCCESS FACTORS FOR LEADERSHIP ROUNDS IN A HEALTHCARE SETTING

Leadership Round Structural Factors	Leader Characteristics and Communication Behaviors
Consistency of who "leads" the Rounds	Leader perceived as being trustworthy
An infrastructure that can be sustained	Leader perceived as a good listener
Limited in focus (one or two focus areas)	Leader perceived to have clinical knowledge
Frequency of Rounds (how often or how many times per year)	Leader knows own personal shortcomings (able to show fallibility)
Involvement of physicians	Leader allows time and space for evaluation and reflection
Involvement of all levels of staff	Leader invites and appreciates contributions from staff

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## LEADERSHIP ROUNDS FOR HAND HYGIENE

**Challenge:**

How can leadership rounds work to increase Hand Hygiene compliance at your facility?

Do you have leaders who are willing to spend time rounding – specifically for hand hygiene?

Do you have leaders with good communication skills – this is key!

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American Journal of Infection Control 45 (2018) 303–10

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**American Journal of Infection Control**

Journal homepage: [www.ajicjournal.org](http://www.ajicjournal.org)

ELSEVIER

AJIC  
American Journal of Infection Control

Major Article

**Leadership rounds to reduce health care–associated infections**

Mary Jo Knobloch PhD, MPH <sup>1,2,3,4</sup>, Betty Cheung PhD <sup>2</sup>, Jackson Musuza MD, PhD <sup>1,2</sup>, Susan Rees DNP, RN, CPHQ, CENP <sup>4</sup>, Christopher Green MD <sup>2</sup>, Erin Patterson PhD <sup>1,2</sup>, Nasia Sajdar MD, PhD <sup>1,2</sup>

<sup>1</sup> Division of Infectious Diseases, University of Wisconsin School of Medicine and Public Health, University of Wisconsin–Madison, Madison, WI  
<sup>2</sup> William S. Middleton Memorial Veterans Hospital, Madison, WI  
<sup>3</sup> University of Wisconsin School of Pharmacy, Madison, WI  
<sup>4</sup> University of Wisconsin Hospitals and Clinics, Madison, WI

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## TOOLS YOU CAN USE TO “MIND THE GAP”

KAMISHIBAI CARDS (K CARDS)



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### KAMISHIBAI CARDS (K CARDS)

- The word *Kamishibai* means "paper drama".
- *Kamishibai Cards (K Cards)* have been used in other fields:
  - manufacturing environments (e.g. Toyota Production System) as a management tool.
- In healthcare, K cards have been used in daily rounding to improve HAI bundle compliance
  - Spectrum Health Helen DeVos Children's Hospital (Michigan)
  - American Family Children's Hospital
  - UW Hospitals and Clinics

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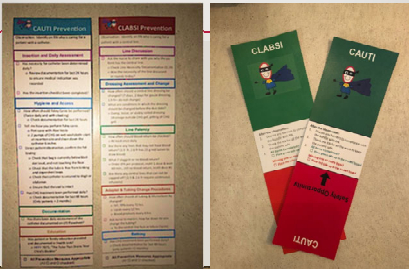
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### K CARDS



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### K CARDS IN PRACTICE



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## K CARDS IN PRACTICE

Updated 4/12	M	T	W	Th	F	Sat	Sun	OPPORTUNITIES
CLASFI	●							12:5
CAUTI		●						15:53
FALLS			●					18
PROXIMAL WOUNDS				●				
DEATHS			●					
PICC					●			
SAFE SLEEP						●		
PRIVE								

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## K CARDS – TOOL TO OPEN COMMUNICATION

- Translating evidence into routine practice challenging.
  - Sustaining new practices is even more difficult.
- There have been few studies addressing sustainability.
  - No other studies have examined K cards to facilitate and sustain best practices
- Sustainability of best practices appears to be non-linear!
- ➔ Sustainability is an **integrative** process of uptake, adaptation, communication, and learning.

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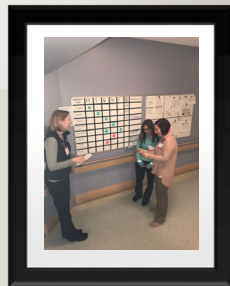
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## OUR STUDY

- Examined K Cards as a tool to encourage compliance interactions between leaders and staff.
- Interactions observed (n=14)
- Interviews recorded and coded (n=22)




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**KEY THEMES**

<ul style="list-style-type: none"> <li>Facilitators           <ul style="list-style-type: none"> <li>Only takes 2-3 minutes</li> <li>K Cards non-threatening</li> <li>Leaders show support (positive language used)</li> </ul> </li> <li>Cues to Action           <ul style="list-style-type: none"> <li>Reminders of bundle elements</li> <li>EMR</li> <li>Viewing the board</li> </ul> </li> <li>Barriers           <ul style="list-style-type: none"> <li>Afraid to fail</li> <li>Inconsistency in who conducts K Cards</li> </ul> </li> </ul>	<p>(1) "I thought it was really cool because it's really quick, it doesn't take a long time. I thought we'd be sitting here for 10 minutes, but it's really just like 2 minutes"</p> <p>(2) "K Cards reinforce education. They also reinforced policy: why do we do these things?"</p> <p>(3) "Our nurse manager frames it very well so that it's not that we're doing something wrong. But we're using this as an opportunity to grow ..."</p>
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**BENEFITS IDENTIFIED BY LEADERS AND FRONTLINE STAFF**

- facilitate patient and family education
- improves compliance
- reminds staff of bundle components
- sets a unit-level learning climate
- promotes staff engagement in problem-solving
- serves as an audit in real time
- promotes the importance of unit quality metrics
- emphasizes individual roles in prevention of HAIs.

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**BENEFITS**

"I definitely think that being consistent and using the K cards makes people more aware, more compliant...Assessing the line every day, talking about the line in rounds every day, charting on what the line looks like is because of the K cards."

"It's a good teaching moment because it's an actual process..."

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### WHAT DO WE KNOW ABOUT K CARDS?

- K cards promote clear lines of communication about evidence-based bundles
- K cards appear to provide psychological safety that made staff feel comfortable bringing up problems and discussing solutions with their manager in real time.
- K cards can enhance a unit-level learning climate and keep evidence-based bundles fresh
- Evidence supports the link between psychological safety and quality improvement
- Evidence supports K cards as successful tool for patient safety

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### USE OF K CARDS – IS SPREADING

- Expansion to all units of the American Family Children’s Hospital, with replication efforts currently under way
  - The nurse leaders on the unit have been asked by hospital leaders to assist in the replication process across all pediatric units.
- Replication in some adult units at UW Hospital
- Nurse Scientists at VA are considering use of K Cards (pilot phase)
- Children’s Mercy Hospital, Kansas, MO
- Emory University Hospital, Atlanta (interested)
- AdvocateAuroraHealth (interested)

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### K CARDS FOR HAND HYGIENE COMPLIANCE

 Challenge:

- How can K Cards improve HH compliance at your facility?
- Who would need to approve the use of K Cards?
- Would facility leaders need to see this in action?
- Who would champion K Cards?

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journal homepage: [www.ajicjournal.org](http://www.ajicjournal.org)

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Infection Control

Check for updates

Major Article

**Kamishibai cards to sustain evidence-based practices to reduce healthcare-associated infections**

Grace Shea BA, MPH<sup>a</sup>, Windy Smith MSN, RN, CPN<sup>b</sup>, Kirsten Koffarnus MS, RN, CPNP<sup>b</sup>,  
Mary Jo Knobloch PhD, MPH<sup>a,c,\*</sup>, Nasia Safdar MD, PhD<sup>d,c</sup>

<sup>a</sup> Department of Medicine, Infectious Disease, University of Wisconsin—Madison School of Medicine and Public Health, Madison, WI  
<sup>b</sup> Department of General Medical/Surgical Pediatrics, American Family Children's Hospital, Madison, WI  
<sup>c</sup> Department of Research Services, William S. Middleton Memorial Veterans Hospital, Madison, WI

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THANK YOU!

CONTACT INFORMATION:

**MARY JO KNOBLOCH, PHD, MPH**  
 KNOBLOCH2@WISC.EDU




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