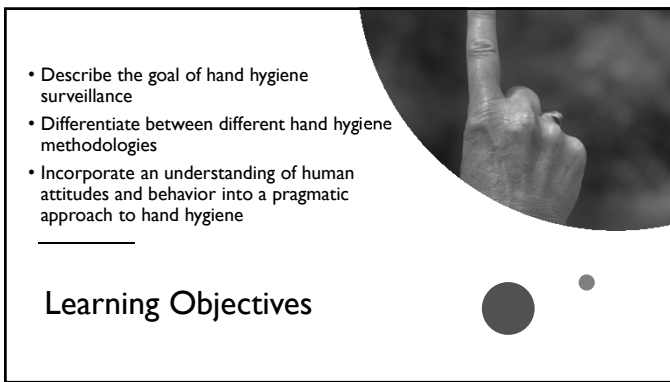


Hand Hygiene Surveillance
the Science and the Pragmatics

Deb Patterson Burdsall PhD, RN-BC,
CIC, FAAPIC
Baldwin Hill Solutions LLC, Infection
Prevention for Long Term Care
Assistant Professor, University of Iowa
College of Nursing



- Describe the goal of hand hygiene surveillance
- Differentiate between different hand hygiene methodologies
- Incorporate an understanding of human attitudes and behavior into a pragmatic approach to hand hygiene

Learning Objectives



Hands Are Amazing




Slide: E. Soda MD



**CLEAN CARE
FOR ALL
IT'S IN YOUR
HANDS**

#HandHygiene #InfectionPrevention #HealthForAll

Source: WHO




Why is Hand Hygiene Surveillance Important?

Hand Hygiene Prevents Infections!

Reported worldwide hand hygiene participation rates ranging from 5% to 89%

Overall average reported to be 38.7%

Pittet, D., Allegranzi, B., & Boyce, J. (2009).



What Have You Touched Today?

shutterstock - 82946368

Slide: E. Soda MD, CDC



What We Are Doing Is Not Working

- Carbapenem Producing Organisms (CPO)
- Spread by healthcare workers
- No decolonization strategy
- Few antibiotic treatment options available
- High mortality rate
- Resistance can hop between bacteria
- High speed/rate of transfer of drug-resistance

Slide: E. Soda MD, CDC

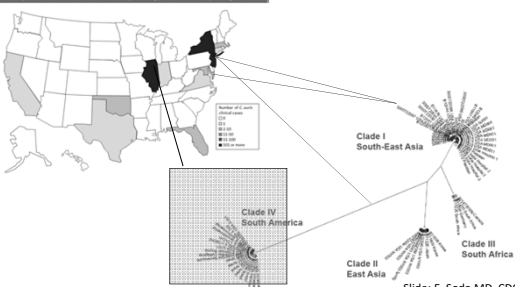


HEALTHY PEOPLE, LOST CARE? **Nursing Homes Are a Breeding Ground for a Fatal Fungus**
Drug-resistant germs, including *Candida auris*, prey on severely ill patients in skilled nursing facilities, a problem sometimes amplified by poor care and low staffing.
Jonathan Moon for The New York Times

8

Candida auris (*C. auris*) Emergence in the US

U.S. Map: Clinical cases of *Candida auris* reported by U.S. states, as of January 31, 2019



Slide: E. Soda MD, CDC
<https://www.cdc.gov/fungal/diseases/candida-auris/index.html>

C. auris Prevalence, March 2017

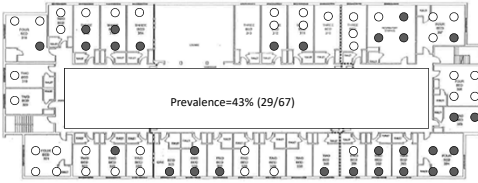


- C. auris positive (1)
- Screened negative for C. auris (65)
- Not tested for C. auris (refused or not in room) (3)

PPS # 1

Black, S.R. CDC Vital Signs Town Hall
April 10, 2018

vSNF A Vent-Floor 1/30/18 C. auris Prevalence

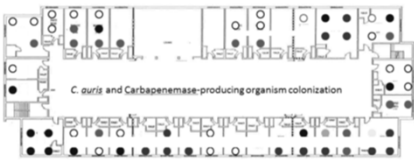


- C. auris positive (29)
- Screened negative for C. auris (33)
- Not tested for C. auris (refused or not in room) (5)

PPS # 2

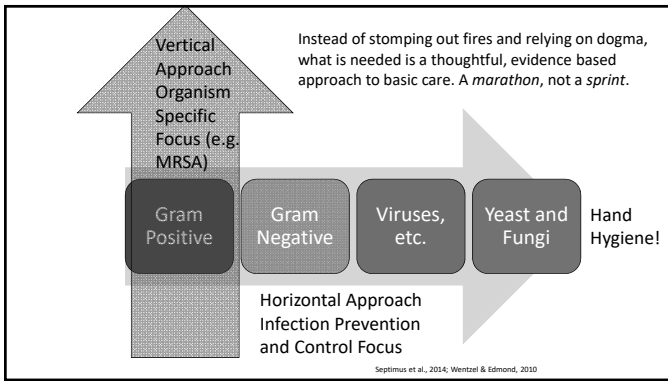
Black, S.R. CDC Vital Signs Town Hall
April 10, 2018

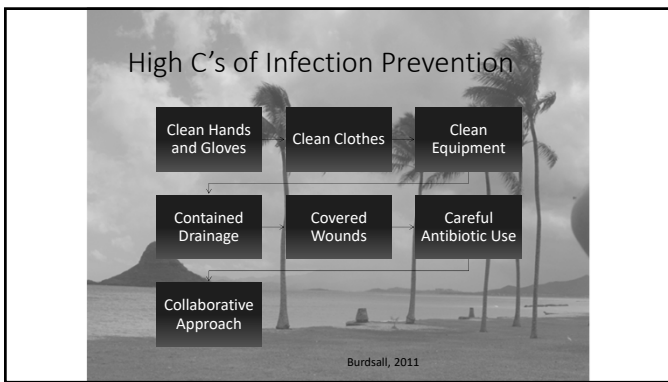
vSNF B Ventilator/Trach Floor January 2018 C. auris and CPO PPS Results



- C. auris
- C. auris and KPC
- KPC or CRE with unknown mechanism of resistance
- C. auris, KPC, and NDM
- C. auris, VISA-CRPA, and KPC
- C. auris and KPC-CRPA
- Screened negative for C. auris, but not tested for CRE
- Screened negative for CRE and C. auris

Black, S.R. CDC Vital Signs Town Hall
April 10, 2018





• <https://youtu.be/s9lyvrez288>

Norwegian Institute of Public Health:
Hand Hygiene and Antimicrobial
Resistance: The Invisible Challenge III




Define Your Hand Hygiene!

Are you using Entry/Exit or 5 Moments or a selection of the 5 Movements? (e.g. 1, 4, 5)

Boyce JM, Am J Infect Control, 2002
WHO Guidelines on Hand Hygiene in Health Care, WHO, 2009

Joint Commission

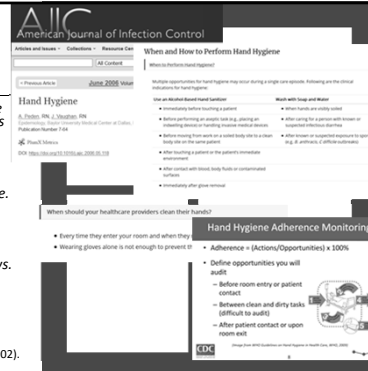
- Can use either CDC or WHO guidelines
- Formulate goal for hand hygiene and improve compliance
- Facility based goals
- *One missed hand hygiene opportunity cited as a deficiency under Infection Prevention and Control (IC) Standard IC.02.01.01, EP 2*



CDC

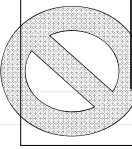
- 1. The following performance indicators are recommended for measuring improvements in HCWs' hand-hygiene adherence:
- Periodically monitor and record adherence as the number of hand-hygiene episodes performed by personnel/number of hand-hygiene opportunities, by ward or by service. Provide feedback to personnel regarding their performance.
- Monitor the volume of alcohol-based hand rub (or detergent used for handwashing or hand antiseptics) used per 1,000 patient-days.
- Monitor adherence to policies dealing with wearing of artificial nails.
- When outbreaks of infection occur, assess the adequacy of health-care worker hand hygiene.

Boyce, J. M., & Pittet, D. (2002).



CDC Centers for Disease Control and Prevention
 CDC 24/7: Saving Lives, Protecting People™

Fingernail Care and Jewelry



- Germs can live under artificial fingernails both before and after using an alcohol-based hand sanitizer and handwashing
- It is recommended that healthcare providers do not wear artificial fingernails or extensions when having direct contact with patients at high risk (e.g., those in intensive-care units or operating rooms)
- Keep natural nail tips less than 1/4 inch long
- Some studies have shown that skin underneath rings contains more germs than comparable areas of skin on fingers without rings
- Further studies are needed to determine if wearing rings results in an increased spread of potentially deadly germs

CDC Centers for Disease Control and Prevention
 CDC 24/7: Saving Lives, Protecting People™

Techniques for Washing Hands with Soap and Water

- The CDC [Guideline for Hand Hygiene in Healthcare Settings](#) (PDF – 1.3 MB) recommends:
 - When cleaning your hands with soap and water, wet your hands first with water, apply the amount of product recommended by the manufacturer to your hands, and rub your hands together vigorously for at least 15 seconds, covering all surfaces of the hands and fingers.
 - Rinse your hands with water and use disposable towels to dry. Use towel to turn off the faucet.
 - Avoid using hot water, to prevent drying of skin.
- Other entities have recommended that cleaning your hands with soap and water should take around 20 seconds.
- Either time is acceptable. The focus should be on cleaning your hands at the right times.

WHO Definition of Handwashing



How to Handwash?

WASH HANDS WHEN VISIBLY SOILED! OTHERWISE, USE HANDRUB

Duration of the entire procedure: 40-60 seconds


- 1 Wet hands with water
- 2 Apply enough soap to cover all the surfaces
- 3 Rub hands palm to palm
- 4 Right palm over left dorsum with interlocking fingers and vice versa
- 5 Back of left hand against right palm with fingers interlocked
- 6 Rub hands side to side
- 7 Rotate hands to wash wrists and forearms
- 8 Rub heel of right hand against left palm with fingers interlocked
- 9 Rub heel of left hand against right palm with fingers interlocked
- 10 Use thumb to rub off thumb
- 11 Rub back of right hand with left palm and vice versa
- 12 Rub back of left hand with right palm and vice versa
- 13 Rub tips of fingers against the palm of the other hand and vice versa
- 14 Rub fingertips against the palm of the other hand and vice versa
- 15 Dry hands with a clean towel

World Health Organization Patient Safety SAVE LIVES Clean Your Hands



Kanamori, H., Weber, D. J., & Rutala, W. A. (2016). CDC

- **Beware of water reservoirs! Water management is critical!!**
- Bacteria
 - *Legionella* and other Gram-negative bacteria
 - Nontuberculous *Mycobacteria*
 - *Elizabethkingia meningoseptica* (EKM)
 - *Elizabethkingia anopheles* (EKA)
 - *Acinetobacter baumannii* (also dry surfaces)
- Occasional fungi and viruses
- Waterborne outbreaks occurred in healthcare settings
- Emergence of new reported reservoirs
 - Electronic faucets (*Pseudomonas aeruginosa* and *Legionella*)
 - Sinks (EKA, EKM, CRE)
 - Decorative water wall fountains (*Legionella*)



Centers for Disease Control and Prevention
CDC 24/7: Saving Lives. Protecting People™

Techniques for Using Alcohol-Based Hand Sanitizer

When using alcohol-based hand sanitizer:

- Put product on hands and rub hands together
- Cover all surfaces until hands feel dry
- This should take around 20 seconds

How to Handrub?

WASH HANDS FOR HAND HYGIENE! WASH HANDS WHEN VISIBLY SOILED

Duration of the entire procedure: 20-30 seconds



1. Apply a dime-sized amount of the product to a cupped hand, avoiding all surfaces.



2. Rub hands palm to palm.



3. Rub palm over the back of the other hand with interlaced fingers and thumb.



4. Rub palm to palm with fingers interlaced.



5. Rub backs of fingers to opposing palm with fingers interlaced.



6. Rub thumb with palm of the other hand.



7. Rub thumb with back of the other hand.



8. Rub fingertips with palm of the other hand.



9. Rub fingertips with back of the other hand.



WHO Definition of Hand Rub





Guide to Implementation

A Guide to the Implementation of the WHO Multimodal Hand Hygiene Improvement Strategy



What is a Multimodal Approach?


The 5 part WHO Multimodal Hand Hygiene Improvement Strategy

- System change – alcohol-based handrub at the point of care
- Training and education
- Observation and feedback
- Reminders in the workplace
- Creating a safety culture

The WHO 5 steps to implementation


Step 1: Facility preparedness	Months 1-3
Step 2: Baseline evaluation	Months 4-5
Step 3: Implementation	Months 6,7,8
Step 4: Follow-up evaluation	Months 9-10
Step 5: Action planning & review	Months 11-12

© World Health Organization



What is Surveillance?

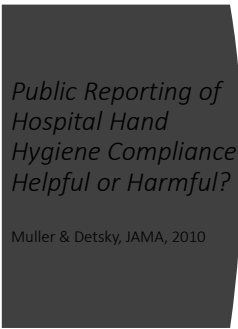
- “The ongoing, systematic collection, analysis, and interpretation of health-related data essential to planning, implementation, and evaluation of public health practice, closely integrated with the timely dissemination of these data to those responsible for prevention and control.” CDC / Thacker & Birkhead, 2008





- “A process is the series of steps taken to achieve an outcome.” Lee et al., AJIC 2007

What is Process Surveillance?

What are we trying to achieve?




Public Reporting of Hospital Hand Hygiene Compliance- Helpful or Harmful?
Muller & Detsky, JAMA, 2010

-  Evidence-Based Strategies
Protect People
-  Indicator-Based Strategies
Protect Reputation

Indicator-based or Evidence-based?

- Hand hygiene rates as an outcome for a hand hygiene program → **Indicator-based**
- Hand hygiene rate monitoring tied to infection rates → **Evidence-based**




REMEMBER

The desired outcome is not just improved hand hygiene





The desired outcome should be reduced infection and colonization

Direct Observation


- Gold Standard
- Portable
- Adaptable
- Paper tool or electronic tool
- Observe technique (does HH meet definition?)
- Time, labor, and training intensive
- Hawthorne Effect
- Sample size challenges



Sources: Boyce, 2017, 2019

		<h2>Hand Hygiene Apps</h2> <p>Free hand hygiene observation apps. Can be customized to adapt to specific units and tasks.</p> <p><small>© 2017-2019 by Swipesense, Inc. All rights reserved.</small></p>
		
		


Electronic Surveillance



- Badges, dispenser activation or door entry
- Reduced Bias and Hawthorne effect
- Automated data analysis
- Covers all shifts
- Expense
- Placement
- Installation and maintenance
- Validation

Sources: Boyce, 2017, 2019
Images: Swipesense

Cameras



- Reduced Bias
- Reduced Hawthorne effect
- Covers all shifts
- Qualitative information (quality and timing of hand hygiene)
- Expense
- Placement
- Installation and Maintenance
- Data analysis
- Privacy concerns

Sources: Boyce, 2017, 2019

Ward, Schweizer, Polgreen, Gupta, Reisinger, Perencevich, (2014)

Automated and electronically assisted hand hygiene monitoring systems: A systematic review

- Assess the existing evidence (42 articles included)
- Adoption and accuracy of automated systems
- Electronically enhanced direct observations
- Reviews of the effectiveness of such systems in health care settings
- *Most sensor networks or monitoring systems only capture Moments 1 and 4, recorded by proxy room entry and exit.*
- *Future studies should be undertaken that assess the accuracy, effectiveness, and cost-effectiveness of such systems.*
- *Facilities should pilot test systems compared to gold-standard, directly observed compliance surveillance.*

Sunkesula et al., 2015

Comparison of hand hygiene monitoring using the 5 Moments for Hand Hygiene versus a wash in-wash out method.

- Direct Observation of 283 room entries
- 70% vs 72%
- Wash in/wash out required 148 hand hygiene events not required by 5 Moments
- Similar overall rates of hand hygiene compliance
- 75% private rooms

Entry/Exit

What about rooms with more than one patient?

Treat each resident area as a separate room

Elaine L. Larson PhD, RN,
FAAN, CIC

Anna C. Maxwell Professor of Nursing Research and Professor of Epidemiology

Senior Associate Dean of Scholarship and Research

Research Activities: Relationship between home hygiene and transmission of infectious diseases Development of antimicrobial resistance Health-care associated infections Prevention and control of infectious diseases, with emphasis on skin antisepsis and healthcare-associated infections

Education & Training

B.S., University of Washington
M.A., University of Washington
Ph.D., University of Washington



•“Pressure to report high hand hygiene rates may create negative consequences.”

Monitoring hand hygiene:
Meaningless, harmful, or helpful? (AJIC, 2013)

Find out what is really happening with hand hygiene.
Work from an evidence-based framework, not an indicator based framework.
Separate the real from the ideal.
Start from a baseline of reality.

Considerations

- What is Positive Deviance?
- What is Human Factors Engineering?
- What is a Multimodal Approach?
- What is a Quality Assurance Performance Improvement Project?
- What is an Interdisciplinary Team?
- Why Should I Care? This is a presentation about hand hygiene surveillance!



Find Change Champions

- Individuals or groups who figure out uncommon behaviors and strategies
- Find better solutions to problems than their peers
- Access to the same resources and facing similar or worse challenges
- Asset-based, problem-solving, community-driven approach
- Enables the community to discover successful behaviors and strategies and
- Develop a plan of action



Positive Deviance

Source: Positive Deviance Collaborative

Gould, Navaie, Pursesell, Drey & Creedon (2017)

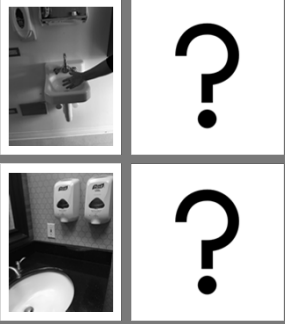
Changing the paradigm: messages for hand hygiene education and audit from cluster analysis.

- Communicated and received input from healthcare personnel
- Positive opinions
- Pragmatism
- Skepticism

Wash_with_soap_and_water_best
 Need_at_Point_of_Care
 Don't_Like
 I_like_this I_don't_think_ABHR_works
 ABHR sanitizer
 Needs_to_Smell_Nice
 Need_Good_Hand_Sanitizer

Human Factors Engineering

- *“Examines the relationship between human beings and the systems with which they interact.”* (Kohn, Corrigan, Donaldson, 1999)
- *“Define human factors as: the study of all the factors that make it easier to do the work in the right way.”* (WHO)



Dunne, Kingston, Slevin & O'connell (2018)

Editorial.
Hand hygiene and compliance behaviours are the under-appreciated human factors pivotal to reducing hospital-acquired infections

- Focus on hand hygiene is timely and worthy
- Represents a quandary
- *“Hand cleansing is simultaneously a simple activity and an activity too simple for those sometimes seeking elaborate solutions to healthcare associated infection challenges globally.”*
- Increased data increases healthcare system complexity
- Communicate with healthcare personnel

Jacob, Herwaldt & Durso 2018

Preventing healthcare-associated infections through human factors engineering

- Healthcare personnel need help
- Reduce and simplify steps in delivering care
- Simplify workflow
- Communicate and receive input from healthcare personnel

Gould, Navaie, Purssell, Drey & Creedon (2017)

Changing the paradigm: messages for hand hygiene education and audit from cluster analysis.

- *How healthcare workers accept and make sense of the hand hygiene message is likely to contribute to the success and sustainability of initiatives to improve performance.*
- Cluster analysis identified clusters of belief about hand hygiene

Caris, Labuschagne, Dekker, Kramer, van Agtmael, Vandenbroucke-Grauls (2017)

Nudging to improve hand hygiene.

- Nudging “A friendly push to encourage desired behavior.”
- Communicated and received input from healthcare personnel
- Reminders based on cognitive biases
- Posters



Hand Hygiene in Skilled Nursing

- Nursing homes **MUST** develop, implement, and maintain an effective, comprehensive, data-driven QAPI program
- Focuses on indicators of the outcomes of care and quality of life
- Interdisciplinary team
- Family members may bring a different perspective
- Communicate and receive input from healthcare personnel



- **The QAPI plan**
- *Process for identifying and correcting quality deficiencies*
- *Track and measure performance*
- *Establish goals and thresholds for performance measurement*
- *Identify and prioritize quality deficiencies*
- *Systematically analyze underlying causes of systemic quality deficiencies*
- *Develop and implement corrective action or performance improvement activities*
- *Monitor or evaluating the effectiveness of corrective action/performance improvement activities*
- *Revise as needed*




CMS.gov
Centers for Medicare & Medicaid Services

Interdisciplinary Team Approach: Required Participants

QAPI
at a Glance

Performance Improvement Projects (PIP)

- Implement performance improvement projects
- Focus on meaningful topics
- Charter PIP teams
- Communicate and receive input from healthcare personnel
- Support staff in being effective PIP team members
- Use tools that support effective teamwork
- Plan, implement, measure, monitor, and document changes, using a structured PI approach




CMS.gov
Centers for Medicare & Medicaid Services

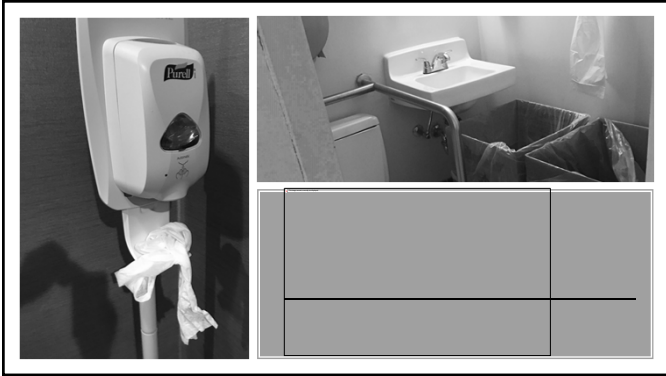
Performance Improvement Project (PIP) Inventory

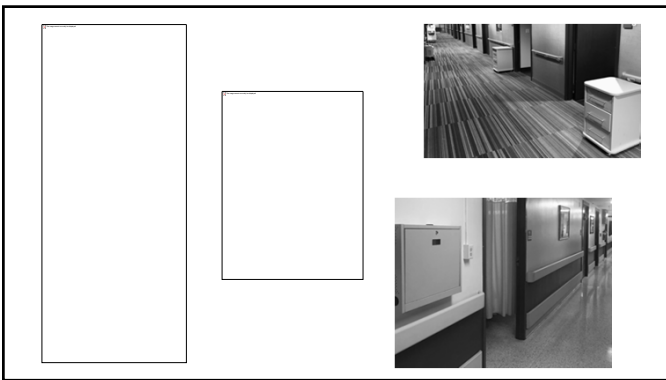
Use this template for high level tracking of all PIPs occurring within your unit. It may be particularly useful for leadership, supervisors, or others responsible for PIPs. Consider updating the status column on a regular basis, e.g., quarterly. Use the QAPI team meetings, to review all PIPs that the organization has current PIPs are moving along, if any have stalled, etc.

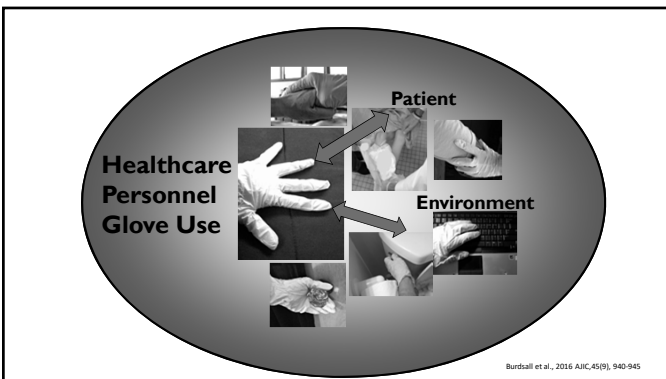
Name of Reviewer		Start Date	End Date	Status	Notes

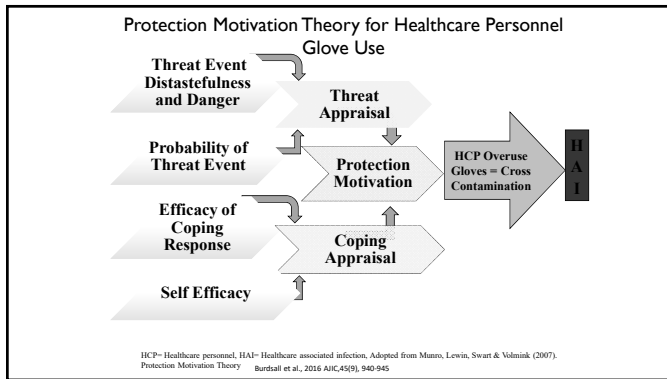
Barriers

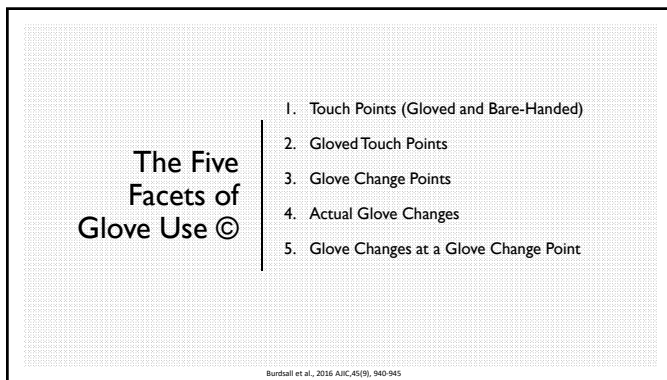


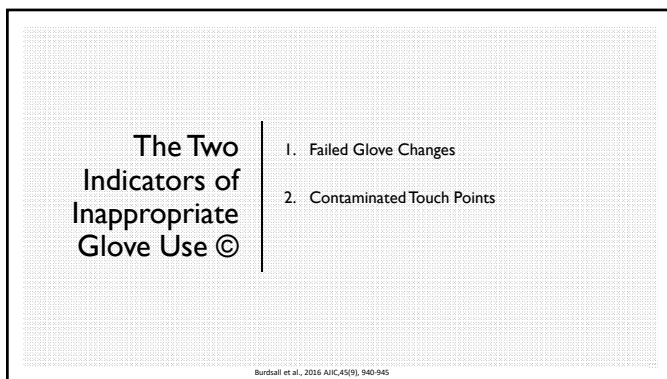


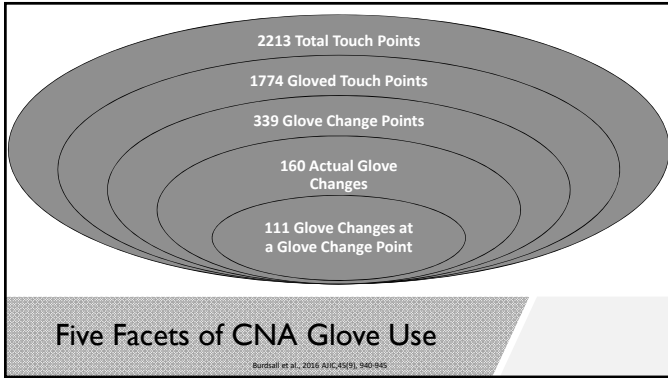
























Contaminated Touch Points



Contaminated touch points



Contaminated touch points

Two Indicators of Inappropriate CNA Glove Use

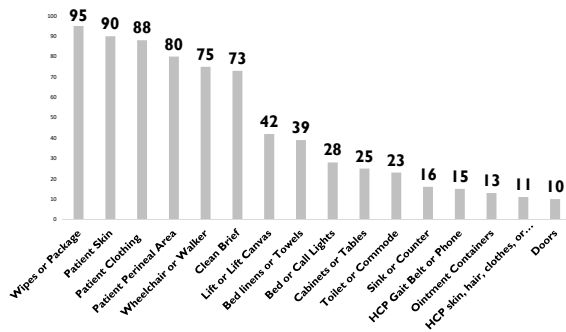


227 FAILED OR MISPLACED GLOVE CHANGES



782 CONTAMINATED TOUCH POINTS

Burdall et al., 2016 AJIC,45(9), 940-945



Burdall et al., 2016 AJIC,45(9), 940-945

71



Norwegian Institute of Public Health:
The Invisible Challenge II – Spread of bacteria in hospital settings

• <https://youtu.be/9R8fHo6WfzY>



What Does this Mean for Hand Hygiene Surveillance?

- Humans perform hand hygiene, 24/7: Don't forget that
- Know why you are collecting hand hygiene data
- Know what your compliance really is, don't fool yourself
- Look for hidden barriers
- The people who do the work already have the solutions
- Involve the interdisciplinary team in solving the problems
- Mixed surveillance (electronic plus direct observation) may give a more balanced and accurate reflection of true hand hygiene (Boyce, 2017,2018)
- Focus on the long game: Evidence-based improvement in hand hygiene to reduce infections, not to game the system takes time and interdisciplinary approaches



Realize we are part of a larger healthcare community and must work together in a spirit of cooperation.





Questions?
Dburdsall@gmail.com

References

- Agency for Healthcare Research and Quality (AHRQ) <https://www.ahrq.gov/>
- Andersen, B. M. (2019). Hand Hygiene and Glove Use. In *Prevention and Control of Infections in Hospitals* (pp. 111-127). Springer, Cham.
- Association for Professionals in Infection Prevention and Control (APIC) www.apic.org
- Boyce, J. M. (2019). Current issues in hand hygiene. *American journal of infection control*, 47, A46-A52.
- Boyce, J. M. (2017). Electronic monitoring in combination with direct observation as a means to significantly improve hand hygiene compliance. *American journal of infection control*, 45(5), 528-535.
- Boyce, J. M., & Pittet, D. (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. *Infection Control & Hospital Epidemiology*, 23(S12), S3-S40.
- Burdsall, D. P., Gardner, S. E., Cox, T., Schweizer, M., Culp, K. R., Steelman, V. M., & Herwaldt, L. A. (2017). Exploring inappropriate certified nursing assistant glove use in long-term care. *American journal of infection control*, 45(9), 940-945.
- Centers for Disease Control and Prevention (CDC) <https://www.cdc.gov/>
- Centers for Disease Control and Prevention (CDC) 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.
- Cheng, V. C. C., Wong, S. C., Wong, S. C. Y., & Yuen, K. Y. (2018). 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.
- (2019). Directly observed hand hygiene—from healthcare workers to patients. *Journal of Hospital Infection*, 101(4), 380-38.
- Drews, E. A., Vignovsky, L. C., & Mayer, J. (2019). Human factors engineering contributions to infection prevention and control. *Human factors*, 0018720819883214.
- Dunne, C. P., Kingston, L., Slevin, B., & O'Connell, N. H. (2018). Hand hygiene and compliance behaviours are the under-appreciated human factors pivotal to reducing hospital-acquired infections. *Journal of Hospital Infection*, 98(4), 328-330.
- Erasmus V, Brouwer W, van Baeck EF, Oenema A, Dahe T, Richardus JH, Vos MC, Brug J. 2009. A qualitative exploration of reasons for poor hand hygiene among hospital workers: Lack of positive role models and of convincing evidence that hand hygiene prevents cross-infection. *Infect Control Hosp Epidemiol* 30(5):415-9.
- Evans HL, Lefrak SN, Lyman J, Smith RL, Cheng TW, McElearney ST, Schulman AR, Hughes MG, Raymond DP, Pruett TL, et al. 2007. Cost of gram-negative resistance. *Crit Care Med* 35(1):89-95.

References

- Gould, D. J., Navale, D., Purcell, E., Drey, N. S., & Creedon, S. (2018). Changing the paradigm: messages for hand hygiene education and audit from cluster analysis. *Journal of Hospital Infection*, 98(4), 345-351.
- Hand Hygiene: Seeing Is Believing - Longwoods.com [Internet] [cited 2011 5/4/2011]. Available from: <http://www.longwoods.com/proxy.lib.uiowa.edu/content/20738>.
- Infection Prevention Guide to Long-Term Care, 2nd edition, (2019). Arlington: The Association for Professionals in Infection Control and Epidemiology (APIC).
- Jacob, J. T., Herwaldt, L. A., Durso, F. T., & CDC Prevention Epicenters Program. (2018). Preventing healthcare-associated infections through human factors engineering. *Current opinion in infectious diseases*, 33(4), 353-358.
- The Joint Commission. *Acceptable Practices of Using Alcohol-Based Hand Rub*. Retrieved from <https://www.jointcommission.org/assets/1/18/464practicesofusingalcoholbasedhandrub.pdf>
- Larson, E. (2013). Monitoring hand hygiene: Meaningless, harmful, or helpful? *American journal of infection control*, 41(5), 542-545.
- Lee, T. B., Montgomery, D. G., Marx, J., Olinzof, B. N., & Scheckler, W. E. (2007). Recommended practices for surveillance: Association for Professionals in Infection Control and Epidemiology (APIC), IIC. *American journal of infection control*, 35(7), 421-425.
- Lindberg, C., Norstrand, P., Munger, M., DeMarisco, C., & Buccell, P. (2009). Letting go, gaining control: positive deviance and MRSA prevention. *Clinical Leader*, 2(2), 60-67.
- Lindberg, C., & Clancy, T. R. (2010). Positive deviance: an elegant solution to a complex problem. *JONA: The Journal of Nursing Administration*, 40(4), 150-153.
- Longtin Y, Sox H, Allegretti B, Hugonnet S, Pittet D. 2009. Patients' beliefs and perceptions of their participation to increase healthcare worker compliance with hand hygiene. *Infect Control Hosp Epidemiol* 30(5):520.
- MRSA in healthcare settings (2006) www.cdc.gov
- Muller, M. P., & Detsky, A. S. (2010). Public reporting of hospital hand hygiene compliance—helpful or harmful?. *Jama*, 304(10), 1116-1117.
- National Healthcare Safety Network for Long Term Care <https://www.cdc.gov/nhsn/ltr/index.html>
- NFPA Life Safety Code (2012). Retrieved from <https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/code-codes-and-standards>
- Pieboni, A., & Vaughan, J. (2005). Hand hygiene. *American journal of infection control*, 34(5), 590.
- Pittet, D., & Pittet, D. (2017). Hand hygiene electronic monitoring: Are we there yet?. *American journal of infection control*, 45(5), 464-465.
- Pittet, D., Allegranti, B., & Boyce, J. (2009). The World Health Organization guidelines on hand hygiene in health care and their consensus recommendations • Infection Control and Hospital Epidemiology, 30(7), 611-622
- Rai, N., Saleem, C., Gonzalez-Olita, M. I., Kingston, S., Cadnum, J. L., & Donnelly, C. J. (2019). A pilot study to assess the impact of an educational patient hand hygiene intervention on acquisition of colonization with health care-associated pathogens. *American journal of infection control*, 47(3), 334-339.
- Reilly, J., Price, L., Lang, S., Robertson, C., Cheater, F., Skinner, K., & Chow, A. A pragmatic randomised controlled trial of 6 step versus 3 step hand hygiene technique in acute hospital care.

References

- Smith, A., Carusone, S. C., & Loeb, M. (2008). Hand Hygiene Practices of Health Care Workers in Long-term Care Facilities. *American Journal of Infection Control*, 36(7), 492-494. doi: 10.1016/j.ajic.2007.11.033
- Speedyaudit: https://play.google.com/store/apps/details?id=com.handymetrics.speedyaudit&hl=en_US
- Sunlesula, V. C., Meranda, D., Kundrapu, S., Zaborsky, T. F., McKee, M., Macings, D. R., & Donkey, C. J. (2015). Comparison of hand hygiene monitoring using the 5 Moments for Hand Hygiene method versus a wash in-wash out method. *American journal of infection control*, 43(1), 16-19.
- Swipesense (iScrub Lite) <https://www.swipesense.com/iscrub>
- Ward, M. A., Schweizer, M. L., Polgreen, P. M., Gupta, K., Reisinger, H. S., & Perencevich, E. N. (2014). Automated and electronically assisted hand hygiene monitoring systems: a systematic review. *American journal of infection control*, 42(5), 472-478.
- World Health Organization <http://www.who.int/>
- WHO | Clean Care is Safer Care [Internet] [cited 2011 5/4/2011]. Available from: <http://www.who.int/gpsc/en/>
- WHO | About SAVE LIVES: Clean Your Hands [Internet] [cited 2011 5/4/2011].
