Methods of Monitoring Hand Hygiene Frequency and Compliance

Dr. John Boyce, Hospital of Saint Raphael & Yale University

A Webber Training Teleclass

Methods of Monitoring Hand Hygiene Frequency and Compliance

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Hosted by Paul Webber
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Research support: GOJO

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Methods for Monitoring Hand Hygiene (HH) Compliance

- Direct observation
  - Current "gold standard"
- Self-reporting by healthcare workers (HCWs)
- Indirect measurement of product usage
  - Manual measurement of amount of product used
  - Electronic measurement of usage
- Automated monitoring of compliance

Hass JP & Larson EL J Hosp Infect 2007;66:6
Boyce JM J Hosp Infect 2008;70 (Suppl 1):2

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Direct Observation

- Currently, observational surveys conducted by trained personnel (often IPs) are gold standard
- Advantages of direct observations
  - only method that can assess HH technique
  - only method to detect whether all possible HH opportunities are followed by HCWs
  - one of few methods that can identify type of HCW involved in care
  - can identify situations that require further education of staff

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Direct Observation

- Problems associated with observational surveys
  - time-consuming (costly)
  - only a tiny fraction of HH opportunities are observed
    - are findings statistically valid?
  - may be problems with inter-rater reliability
  - observation may affect behavior (Hawthorne effect)

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Direct Observation

- Problems associated with observational surveys
  - lack of standardization
    - criteria for compliance
      - before, during care, after care
      - touching patients vs environment only
      - HH technique (time, completeness of HH)
    - observation technique
      - type of observers used
      - level and type of training
      - duration of observation periods
      - shifts included (days only, all shifts, weekends)

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www.who.int/gpsc/5May/en

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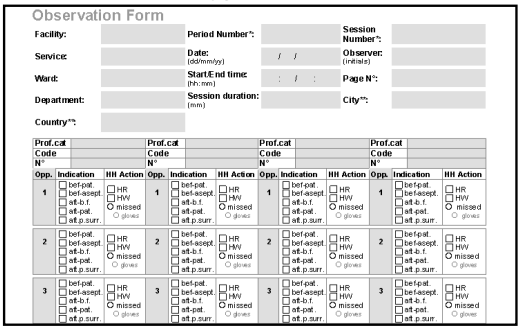
WHO Hand Hygiene Observation Tool



www.who.int/gpsc/5May/en

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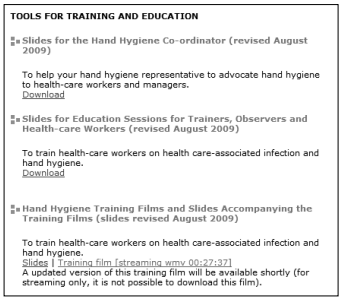
WHO Training Film and Accompanying Slides

Go to: www.who.int/gpsc/5may/en
Click on: Tool and Resources
Click on: Tools for training and education, and then page down



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Use of Mobile Digital Devices to Facilitate Direct Observational Surveys

- Wireless or Internet-capable mobile devices (PDA, smartphone)
- Software or smartphone app used to record hand hygiene observations by observers
- Observations recorded on mobile device
  - uploaded wirelessly to on-site server for data storage and analysis
  - Emailed to observer for easy analysis
  - Uploaded to dedicated Internet website for analysis

Hlady CS et al. ICHE 2010;31:975
Cooper LM et al. Decennial 2010 Conference, abstr 264
Kahlert C et al. ICAAC 2010, abstr K-513

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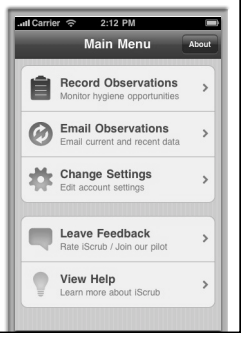
iScrub Lite 1.5 App

- Highly customizable
- Obviates the need for transcription
- Exported data can be opened in Excel
- Intuitive interface
- Free!



University of Iowa compepi computational epidemiology research

iScrub Features

- Record opportunities for the World Health Organization's 5 Moments of Hand Hygiene
- Observations are time and location stamped
- Available free at iTunes App Store

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Monitoring Hand Hygiene Compliance- Measuring Product Usage

- Record amount (ml) of soap + ABHR used
- Record number of bed-days (patient-days)
- $\frac{\text{ml of soap used/bed-days}}{\text{1.7 ml soap used per HH episode}} = \frac{\text{HH episodes}}{\text{bed-day}}$
- Same calculation for ABHR
  - Currently being used in numerous sites in USA
  - Little or no data on how method compares to direct observation

McGuckin M et al. Am J Infect Control 1999;27:309

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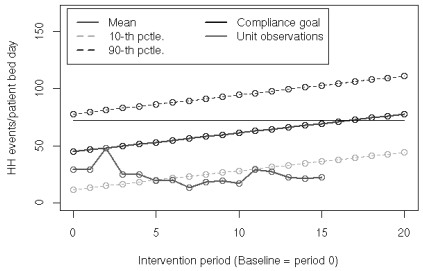
Sample Monthly Hand Hygiene Report

Unit B Soap + San combined (Beds: 101-300 , Category: NON-ICU



www.hhreports.com/

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Automated Monitoring Systems

- Electronic monitoring of product usage
- Motion sensing systems to detect room entry/exit and use of hand hygiene dispensers, +/- reminders
  - Without identifying persons entering/exiting room
- Real-time Locating Systems (RTLS) to track HCW movements and use of hand hygiene products
- Video monitoring of HCW hand hygiene activity

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Electronic Monitoring of Product Usage

- Electronic counting devices can be placed inside dispensers for alcohol handrub or soap
- Record each time the dispenser is accessed 24 hrs per day/7days per week
- Measure hand hygiene frequency, not compliance rates

Larson EL et al. Am J Crit Care 2005;14:304
Kinsella G et al. J Hosp Infect 2007;66:34
Boyce JM et al. ICHE 2009;30:1090
Marra AR et al. ICHE 2010;31:796

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Electronic Monitoring of Product Usage

- Electronic devices were placed inside ABHR product dispensers
- Electronic devices recorded each time the dispenser is accessed (HH event)
- HH events were time/date stamped
- HH event data stored in the device's database were downloaded to a wireless, portable "data logger" and then uploaded to a dedicated website for analysis

Boyce JM et al. ICHE 2009;30:1090

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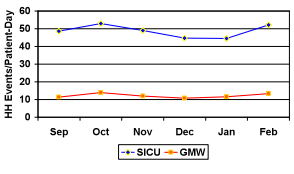
Hand Hygiene Events per Patient-Day, by Ward and by Month, SEP - FEB

During the 6-month trial, 150,307 HH events occurred on the 2 wards

SICU
- N = 105,462 HH events
- Mean HH Events/Pt-Day
  - 48.7

GMW
- N = 44,845 HH events
- Mean HH Events/Pt-Day
  - 12.2



Boyce JM et al. ICHE 2009;30:1090

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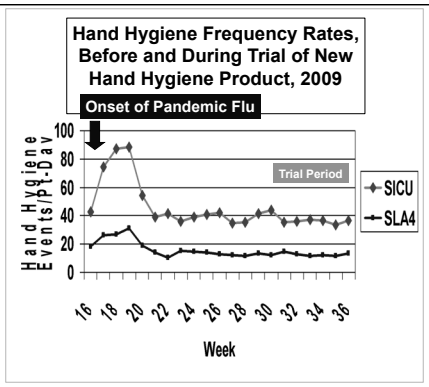

Boyce JM et al. Decennial 2010 Conference, abstr 270

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Electronic Monitoring of Product Usage

- 12-week prospective observational study in an ICU
- Direct observations, product usage (mls), and electronic counting devices in handrub dispensers
- Overall hand hygiene compliance rate based on observation of 2,249 opportunities = 62%
- 76,389 hand rub dispensing episodes occurred with mean of 53.8 episodes/patient-day
- 64 ml of handrub + 33.8 mls soap used/patient-day

Marra AR et al. ICHE 2010;31:796

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Electronic Monitoring of Product Usage

- 2,249 observed opportunities represented only 1.3% of the estimated 172,457 opportunities
  - Noted that in many healthcare facilities, direct observations account for substantially < 1% of all hand hygiene opportunities
- No significant correlation between observed rate of compliance and alcohol handrub consumption or total volume of handrub + soap products used

Marra AR et al. ICHE 2010;31:796

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Electronic Monitoring of Product Usage

- Advantages of measuring product usage
  - Much less labor intensive
  - Feasible for all wards over prolonged period
  - No selection bias
- Problems associated with product usage
  - Can't identify if HH was performed at right time
  - No way to assess technique
  - Information on compliance by HCW type is not possible
  - Not clear how well product usage correlates with direct observation in terms of compliance levels
- Further studies are needed to correlate product usage measurements with observational data

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Electronic Monitoring of Product Usage to Derive Hand Hygiene Compliance Index

- System estimates hand hygiene compliance by
  - (1) real-time electronic product usage for each nursing unit, with data sent to secure website (numerator)
  - (2) statistically valid benchmarks of hand hygiene opportunities/patient-day (denominator)
    - facility can input local benchmarks on hand hygiene opportunities/patient-day (optional)
  - (3) patient perception survey data (optional)
  - Relative weighting of product usage, direct observation, and patient perception surveys
- Software generates HH compliance index, by unit

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Automated Monitoring Systems

- 3-phase intervention in an intermediate care unit
  - 1) electronic monitoring and direct observation
  - 2) electronic monitoring and computerized voice prompts for failure to perform hand hygiene on room exit
  - 3) electronic monitoring only
- Motion sensors detected room entry and exit, and sensors attached to sinks and handrub dispensers detected hand hygiene events
- In Phase 2, computerized voice-prompt system gave one of several messages if hand hygiene not done upon exiting the room

Swoboda SM et al. Crit Care Med 2004;32:358

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Automated Monitoring Systems

- Results: Compared to Phase 1, HH compliance improved 37% during Phase 2, and 41% during Phase 3
- When adjusting for patient admissions during each phase, point estimates of nosocomial infections decreased by 22% during phase 2; 48% during phase 3
- When adjusting for patient days, the number of infections decreased by 10% during phase 2 and 40% during phase 3
- Electronic monitoring provided effective feedback, improved HH compliance & nosocomial infection rates

Swoboda SM et al. Crit Care Med 2004;32:358

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Automated Monitoring Systems

- Prospective intervention study in Hematology unit
  - Phase 1: electronic monitoring of HH compliance
  - Phase 2: electronic prompts (beeps, flashing light, and pre-recorded voice prompt) if HH compliance did not occur
- Motion sensors detected room entry and exit, with HH compliance defined as use of handrub dispenser on room entry and exit
- Concurrent direct observation by trained observers to validate electronic data

Venkatesh AK et al. AJIC 2008;36:199

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Automated Monitoring Systems

- Results: 8235 HH opportunities included in study
- HH compliance improved from 36.3% at baseline to 70.1% during Phase 2
- HH compliance improved on all shifts, and upon room entry and room exit
- Nosocomial VRE infections decreased (not significantly)
- Conclusion: Electronic devices can effectively monitor HH compliance and result in improved compliance rates

Venkatesh AK et al. AJIC 2008;36:199

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Automated RTLS Monitoring Systems

- Real-time locating systems (RTLS) permit identification and tracking of HCWs
  - HCWs wear a special badge (tag)
  - Sensors (readers) located throughout the facility track the location of HCWs using a centralized database and vendor-specific software
  - Readers attached to (or near) hand hygiene product dispensers detect hand hygiene events
- Different vendors utilize various technologies, most commonly wireless
  - RFID, Infrared (IR), RFID/IR, ZigBee, Wi-Fi, Ultra-wideband, Ultrasound

Fries J et al. SHEA 2009
Sahud AG et al. ICHE 2010;31:634
Edmond M et al. Decennial 2010 Conference, Abstr 740

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Electronic Hand Hygiene Monitoring Systems

Electronic Hand Hygiene Monitoring Systems

Hand hygiene station detects alcohol-containing soap or handrub on HCW hands placed under unit

HCW badge reminds HCW if hand hygiene not done upon approaching patient

Bed monitor detects presence of HCW near patient's bed

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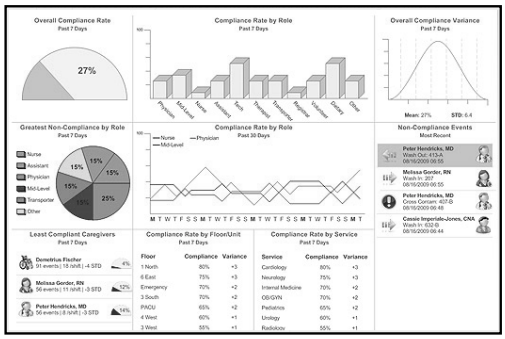

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Automated RTLS Monitoring Systems

- RTLS based on ZigBee technology was developed to track use of hand hygiene products by HCWs
- Sensitivity, specificity, (+) and (-) predictive values were determined based on trained observers
- Hand hygiene compliance defined as use of hand hygiene dispenser by HCW upon room entry & exit
- Results:
  - Sensitivity: 91 – 97%; Specificity: 100%
  - PPV: 100%; NPV: 96 – 99%
- Conclusion: practical and inexpensive system to determine hand hygiene compliance

Fries J et al. SHEA 2009

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Automated RTLS Monitoring Systems

- 2-phase observational study
  - I. Direct observation of baseline compliance rates
  - II. Use of radio-frequency readers and triggers to detect room entry/exit and use of soap and alcohol-based handrub dispensers; feedback to participants
- Results:
  - Manual recording of room entry/exit and dispenser use by the investigator revealed that 98% of room entries & 95% of dispensing events were captured by the system
  - Overall hand hygiene compliance rate for Phase I (32%) was higher than during Phase II (25%)
- Conclusion: Automated system may provide more reliable compliance rates, including during evening hours

Sahud AG et al. ICHE 2010;31:634

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Automated RTLS Monitoring Systems

- 2-phase intervention study on 35-bed ward with alcohol foam dispensers inside/outside each room
- Phase 1: 4 weeks (100 hrs) of direct observation of HH compliance rates; no feedback given to HCWs
- Phase 2: 2-week period with nurses wearing alcohol sensor badges
- At room entry and exit, badge is activated at doorway

Edmond MB et al. J Hosp Infect 2010 (Epub)

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Automated RTLS Monitoring Systems

- After performing hand hygiene with alcohol-based product, HCW places hand near badge
- If alcohol is detected w/in 8 sec of room entry or exit, the badge light turns green and emits audible "ping"
- If alcohol is not detected, badge light turns red and emits a beeping noise
- Compliance data are sent wirelessly to centralized database for monitoring

Edmond MB et al. J Hosp Infect 2010 (Epub)

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Automated RTLS Monitoring Systems

- Results: HH compliance rate for nurses increased
  - Baseline: 72%
  - Intervention phase: 92% (range 72 – 100%) ($p < 0.0001$)
- Conclusion: Use of badge system resulted in significant increase in HH compliance
- Limitations:
  - Short-term study on single ward
  - Detected only compliance using alcohol-based product

Edmond MB et al. J Hosp Infect 2010 (Epub)

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Automated Video Monitoring Systems

- Multiple video cameras were used to monitor use of soap or handrub dispensers by HCWs upon entry and exit to an MICU
- External auditors scored use (Pass) or no use (Fail) of dispensers in real-time, 24/7
- Auditor managers performed quality audits of 5% of events to assure validity
- 4-month baseline period, followed by 6-month period with feedback displayed on electric boards updated q 10 min with compliance rates, and emails q shift to MICU managers

Armellino D et al. ICAAC 2009, abstr K-518

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Automated Video Monitoring Systems

- Compliance increased from a baseline of < 10% to 89% in the last 4 months of trial period (p < .0001)
- Conclusion: Remote video monitoring of hand hygiene, with real-time feedback to HCWs resulted in a significant increase in hand hygiene compliance

Armellino D et al. ICAAC 2009, abstr K-518

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Automated Monitoring Systems

- Issues requiring further study
  - Infrastructure
    - Cost & ease of installation of infrastructure; other uses?
    - Ability of systems to define patient zone in multi-bed rooms
    - Percent of hand hygiene opportunities captured
    - Detection of opportunity at bedside (e.g., aseptic procedure)
    - Detection of compliance when patients not confined to bed
    - Impact on compliance rate if HCW does not touch patient or environment
    - Type of real-time reminders given to HCW by badge
    - Reliability of compliance data with video systems
    - Estimates of return on investment (ROI)

Boscart VM et al. AJIC 2010;38:518

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Automated Monitoring Systems

- Issues requiring further study
  - Acceptability by HCWs
    - Willingness to wear badge and be individually monitored
      - Preliminary data suggest this may not be problem
    - Will reports of individual compliance be confidential?
    - Knowledge of who will receive data on compliance
      - Nursing managers, infection control, HCW
    - How will feedback be given to HCW
    - How will compliance data be used by administration?
      - Use for annual performance evaluation
    - Potential impact of system on HCW behavior

Boscart VM et al. J Hosp Infect 2008;70:216
Sax H (personal communication)

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Summary

- Direct observation of hand hygiene activities is currently most common method of measuring hand hygiene compliance
  - Provides unique information not available from any other method (HH technique, appropriateness)
  - Will continue to have a role in monitoring compliance
- Shortcomings of direct observation include:
  - Time-consuming and expensive
  - Lack of standardization & Hawthorne effect
  - Only small fraction of HH opportunities can be observed

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Summary

- Measuring hand hygiene product usage
  - Less time-consuming and less expensive
  - Can detect hand hygiene events throughout day on all wards
  - Can detect changes in hand hygiene frequency related to planned interventions or unplanned events (pandemic flu)
- Shortcomings of measuring product usage
  - Measures hand hygiene frequency, not compliance rates
    - Can be used to estimate compliance rates
  - Cannot differentiate HCW from other users
  - How well do data correlate with compliance rates established by direct observation?

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Summary

- **Automated monitoring of compliance**
  - **Can provide HCW-specific data on HH activity**
  - **Can capture many, but not all HH opportunities**
    - **Particularly WHO Moments 1, 4 and 5**
  - **Provides real-time compliance data with automated analysis by HCW, Unit, etc.**
  - **A few preliminary studies suggest they can lead to substantial improvement in HH compliance rates**
- **Further studies are needed to establish**
  - **Acceptability by HCWs, impact on HH compliance rates**
  - **Reliability of compliance rates**
  - **Resource needs, practicality, cost, Return of Investment**

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The Next Few Teleclasses

27 Oct. 10	(*South Pacific Teleclass*) Infection Control in the Tropics Speaker: Claire Boardman, VICNISS, Australia
28 Oct. 10	Implementing Mandatory Vaccination for Healthcare Workers Speaker: Dr. Keith Woeltje, Washington University School of Medicine
04 Nov. 10	Using Social Marketing to Prevent Healthcare Associated Infection Speaker: Dr. Hugo Sax, University of Geneva Hospitals, Switzerland
09 Nov. 10	(British Teleclass) Why are Noroviruses Such Successful Pathogens in Healthcare Settings? Speaker: Dr. Christine Moe, Emory University
18 Nov. 10	Infection Prevention Strategies in the Home Care Setting Speaker: Mary McGoldrick, Home Health Systems Inc.
02 Dec. 10	Validation of Special Ventilation Systems in Healthcare Facilities Speaker: Andrew Streifel, University of Minnesota
09 Dec. 10	Do Decolonization Strategies Work for MRSA? Speaker: Dr. Andrew Simor, Sunnybrook Health Sciences Centre

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