Disclosures

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Objectives

- To review the existing evidence for patient hand hygiene (HH) interventions
- To present data on patient HH rates in hospital measured with an electronic monitoring system
- To discuss the implications of these findings with respect to prevention of healthcare-associated infections (HAIs)

Interventions to Improve Patient Hand Hygiene

A Systematic Review

Background

- Nosocomial pathogens may be acquired by patients via their unclean hands
  - Fecal-oral
  - Indirect contact
- In addition to theoretical considerations, some studies show that interventions to improve patient HH lead to reductions in HAIs
- However there has been little emphasis on patient HH

Research Question

- Do interventions that aim to improve patient HH have an effect on HAI rates compared to usual care?

Objectives

- Primary
  - To determine the efficacy of patient hand hygiene interventions in reducing HAIs (e.g. *Clostridium difficile* infection) or AROs (e.g. methicillin-resistant *Staphylococcus aureus*, vancomycin-resistant enterococci)
- Secondary
  - To determine the efficacy of these interventions in improving patient HH compliance

Eligibility Criteria

- Randomized controlled trials, non-randomised controlled trials, controlled before-after studies, interrupted time series, and quasi-experimental studies
- Evaluate a patient HH intervention conducted in hospital as compared to usual care
- Include HAI/ARO incidence and/or patient HH compliance as an outcome
- Excluded if study did not provide primary data

Search

- Information sources
  - MEDLINE, EMBASE, CINAHL, Web of Knowledge, and the Cochrane Central Register of Controlled Trials (CENTRAL) for all available years
  - Searched reference lists of included studies and relevant review articles
  - Search for unpublished studies and grey literature in the repositories of major infection prevention and control organizations and public health agencies, repositories of dissertations and theses, and Google
- Search strategy developed by experienced librarians

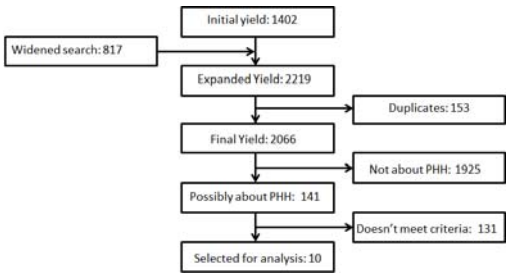
Data Extraction and Quality Assessment

- All steps performed independently by 2 reviewers, with disagreements resolved by a 3rd reviewer
- Quality assessment
  - Cochrane Effective Practice and Organization of Care Group Risk of Bias Assessment Tool for controlled trials and time series[1]
  - Quasi-experimental studies assessed using a design hierarchy described by Harris *et al.*, with risk of bias assessed using the approach taken by Schweizer *et al.*[2, 3]

Data Synthesis

- Heterogeneity in design, intervention and outcome precluded meta-analysis
- Developed summary tables of included studies
- Described outcomes of each study as related to our objectives and explored factors that might explain differences across studies
- Assessed the overall strength of the evidence

Search Results (2013)



Included Studies

- 6 met primary objective (HAIs/AROs)
- 4 met secondary objective (HH compliance)

Thu *et al.*[4]

- Controlled before-after study in 785 patients on 2 neurosurgical units in Vietnam
- Inpatients on 1 unit were given alcohol-based hand rub (ABHR) and HH education
- SSI decreased from 8.3% to 3.8% on intervention unit and increased from 7.2% to 9.2% on control unit (p=0.04 for comparison between units)
- Moderate risk of bias
  - Baseline characteristics of units not similar
  - Potential for contamination?

Peters *et al.*[5]

- Before-after with repeated treatment
- Study population was ~2300 postpartum women on a maternity ward in Germany
- Patients provided with ABHR at bedside x 10 months, then withdrawn x 2 months and reinstated x 2 months
- Puerperal mastitis decreased from 2.90% in controls to 0.66% in intervention patients (p<0.0001)
- Moderate risk of bias

Gagne *et al.*[6]

- Before-after study in a 250-bed community hospital in Quebec
- All inpatients were given HH education and ABHR BID x ~1 year
- Nosocomial MRSA rates decreased from 10.6/1,000 admissions in the year before to 5.2/1,000 during intervention
- High risk of bias
  - Selective outcome reporting?

Cheng *et al.*[7]

- Before-after study of ~900 inpatients admitted to a psychiatric unit in Hong Kong
- Staff gave ABHR to all patients Q4H during the day and observed HH x ~1 year
- Decrease in nosocomial outbreaks during the intervention compared to the year before
  - From 6 outbreaks affecting 66 patients (18.2%) before to 4 outbreaks affecting 23 patients (4.4%) after (p=0.005 for total patients involved)
- High risk of bias

Hilburn *et al.*[8]

- Before-after study on an orthopedic surgery unit in the USA
- Patients given ABHR and education x 10 months; posters reminded HCWs, patients, and visitors about HH; in-services for HCWs
- Nosocomial infection rate decreased from 8.2% in the 6 months before to 5.3% during intervention (p-value not reported)
- High risk of bias

Pokrywka *et al.*[9]

- Before-after study in a 520-bed teaching hospital in the USA
- Added patient hand hygiene added to an existing *C. difficile* infection (CDI) "bundle"
  - Education, reminders, and alcohol wipes on meal trays
  - Staff and volunteers encouraged to clean patient hands at mealtimes
- CDI rate decreased from 10.45/10,000 patient days before to 6.95/ 10,000 after (p=0.0009)
- High risk of bias
  - Regression to the mean?

Lary *et al.*[10]

- Cluster randomized-controlled trial at a children's hospital in the UK
- 6 wards randomized to interactive educational activities using "Glo-Yo," mobile learning technology, or control
- HH rates increased by 31.7% among intervention patients compared to 13.8% in control group (p<0.001)
- Moderate risk of bias

Whiller *et al.*[11]

- Before-after study of 40 inpatients with mobility difficulties
- Hand wipe containers and reminder signs attached to commodes
- Patients surveyed
  - Patients offered wipes *some* of the time increased from 69% before intervention to 100% after
  - Patients offered wipes *all* of the time increased from 50% before to 85% after
- High risk of bias

Ardizzone *et al.*[12]

- Before-after study of ~160 inpatients on 3 surgical units in the USA
- HCWs provided with education and then audited to assess whether they assisted patients with HH
- HCWs assisting with patient HH at 6 moments increased from 17.3% in the 6 weeks before intervention to 44.6% in the 6 weeks after (p=0.0003)
- High risk of bias

Hedin *et al.*[13]

- Before-after study of ~100 patients on 3 units of a rehabilitation centre in Sweden
- Patients received education and ABHR in bathrooms; HCWs gave out alcohol wipes at mealtimes and were encouraged to remind and assist patients with HH
- HH rates increased from "seldom" before intervention to 85% before meals and 49% after toilet use
- High risk of bias

Summary of interventions

- Targets
  - Patients (4/10)
  - Healthcare workers (HCWs) (3/10)
  - Both (3/10)
- Components
  - Provision of product (8/10)
  - Education (7/10)
  - Reminders (3/10)
  - Audit and feedback (1/10)

Automated Measurement of Patient Hand Hygiene Rates

An Observational Study

Indications for Patient Hand Hygiene

- Four "moments" when patient HH may be indicated in order to reduce the risk of HAIs:[14]
  - After toileting
  - Before eating
  - Leaving their room
  - (Entering their room)

[4]PIDAC, 2014.

Hand Hygiene Rates

- Few data on HH rates in hospitalized patients
- Self-report
  - Emergency department patients reported hand hygiene after 62-88% of bathroom visits and after 13-41% of bedside urinal/bedpan uses[15]
- Direct observation
  - "Covert observation" by junior doctors found that hand hygiene was performed by patients 73% of the time during meals[16]
  - Patient and visitor hand hygiene compliance was 67.5% after body fluid exposures and 50.0% after contact with patient surroundings[17]
  - Study on pediatric wards only found 1 child to observe, who had 100% compliance[18]

[15]Luz et al., 2011. [16]Mattam et al., 2012. [17]Randle et al., 2010. [18]Randle et al., 2013.

A New Solution?

- Electronic monitoring systems
  - Counters
  - Real-time locating systems (RTLS)
  - Video monitoring

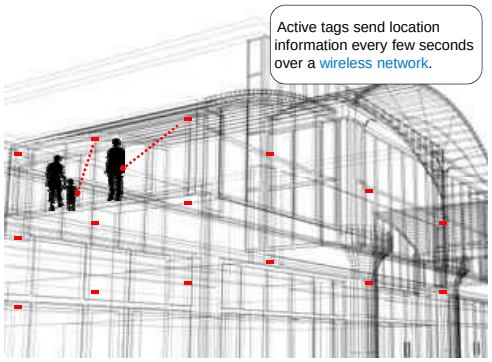
Study Objective

- To characterize patient HH behaviour in an acute care hospital using an RTLS during the following moments:
  - Bathroom visits
  - Before eating
    - Meal times
    - Kitchen visits
  - Room entry and exit

RTLS

- Real-time locating system (RTLS) was installed on two multi-organ transplant units from July 2012 to March 2013
- Generated continuous real-time location data via ultrasound tags worn by staff and patients
- Measured every use of alcohol-based hand rub (ABHR) and soap dispensers


Patients, staff and equipment wear active tags.


Active tags send location information every few seconds over a wireless network.

Bathroom Visits

- All patient bathroom visits were identified
- Exclusion criteria
  - Visits < 30 seconds
  - Visits > 12 minutes
- Patients were associated with a hand hygiene event if they used soap dispenser in bathroom during their visit or ABHR dispenser in the room within 30 seconds of leaving bathroom
- Events attributable to staff were excluded

Before Eating

- Meal times
  - 90-minute window 3 times per day for each patient during times that meal trays were typically delivered
  - Hand hygiene events were attributed to the meal if patients used soap or ABHR during each mealtime window
- Kitchen visits
  - All patient visits to 2 kitchens on the wards were identified
  - Patients were associated with a hand hygiene event if they used the ABHR dispensers surrounding the kitchens up to 30 seconds before entry or the soap dispenser inside the kitchen during their visit
- Events attributable to staff were excluded

Room Entry/Exit

- All patient room entries and exits were identified
- Patients were associated with a hand hygiene event on room entry or exit if they used:
  - Soap dispensers inside their room or bathroom within 30 seconds of entering or 30 seconds prior to exiting
  - ABHR dispenser inside patient room within 30 seconds of entering or 30 seconds prior to exiting
  - ABHR dispenser immediately outside patient room within 30 seconds before entering or 30 seconds prior to exiting
- Events attributable to staff were excluded

Statistical Analysis

- Crude hand hygiene rates calculated for each patient hand hygiene moment
  - Results stratified by sex and by use of ABHR or soap and were compared using Fisher's exact test
- Logistic regression used to calculate odds ratios (OR) for hand hygiene at each moment for patient age group and sex, time of day (AM vs. PM), and day of week (weekday vs. weekend)
- Data analysis conducted using SAS, version 9.3

Patient Characteristics

Variable	All Patients	Females	Males
N (%)	279	119 (42.7)	160 (57.3)
Mean age (95% CI)	52 (50-54)	51 (48-54)	53 (51-55)
Length of stay in days	19 (10-42)	21.9 (11.2- 45)	16.4 (10-36.1)
Number of bathroom visits	31 (14-62)	38 (15-70)	29 (13-54)
Number of meals	15 (9-30)	13 (8.5-28.5)	16 (9-30)
Number of kitchen visits	6 (2-13)	7 (3-15)	4 (2-12)
Number of room entries/exits	20 (8-46)	18 (8-40)	22 (7.5-48)

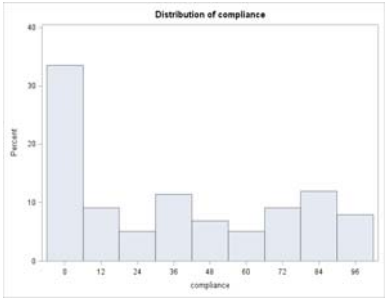
Results: Bathroom Visits

- Number of bathroom visits = 12,649
- Hand hygiene rate 29.7%
  - 92% of hand hygiene events involved soap
- Hand hygiene more likely among women
  - OR 1.77 (95% CI 1.64 to 1.91)
- Hand hygiene more likely after 12:00 pm
  - OR 1.31 (95% CI 1.22 to 1.42

Visit Duration

Duration (min)	Number of Visits	Overall Compliance (%)	Soap (%)	ABHR (%)
< 1	2,000	4.55	2.30	2.35
1-2	3,288	23.54	20.65	3.95
2-3	2,649	39.37	37.45	3.25
3-4	1,476	40.38	37.80	5.01
4-5	846	36.88	34.87	4.73
5-6	701	40.37	37.95	6.13
6-7	528	38.64	36.74	3.98
7-8	440	42.95	39.77	5.00
8-9	371	39.35	37.20	4.31
9-10	280	38.57	32.86	8.93
10-11	249	38.96	36.14	6.02
11-12	203	36.95	35.47	2.96

Distribution of HH Rates



*n=176 patient-room stays

Results: Before Eating

- Number of meal times = 6,005
  - Hand hygiene rate 39.1%
  - Ranged from 32.2% at breakfast to 45.9% at dinner
  - Compared to breakfast, the adjusted ORs were 1.36 (95% CI 1.20 to 1.55) for lunch and 1.79 (95% CI 1.58 to 2.04) for dinner
- Number of kitchen visits = 1,122
  - Hand hygiene rate 3.3%

Results: Room Entries/Exits

- Number of room entries = 5,786
  - Hand hygiene rate 2.9%
- Number of room exits = 5,779
  - Hand hygiene rate 6.7%
- Hand hygiene more likely:
  - On room exit compared to entry (OR 2.34, 95% CI 1.94 to 2.81)
  - In the afternoon (OR 1.72, 95% CI 1.38 to 2.15)
  - On weekdays (OR 1.40, 95% CI 1.13 to 1.73)

Limitations

- Measured HH events, not compliance
  - It is impossible to know what patients were doing in the bathroom or kitchen
- Some HH events may have been performed by untagged healthcare workers or visitors
- Not all patients on the wards wore RTLS tags
- Study conducted with a relatively small number of observations on multi-organ transplant units

Implications

Summary of Systematic Review

- Interventions to improve patient HH may reduce HAIs, but quality of evidence is low
- Focusing on patients rather than HCWs and providing hand sanitizer at the bedside appear to be important

Summary of Patient HH Rates

- Patients perform HH infrequently in hospital
  - Bathroom visits 29.7%
  - Meal times 39.1%
  - Kitchen visits 3.3%
  - Room entry 2.9%
  - Room exit 6.7%

Implications

- Patient hand hygiene may be as important as HCW hand hygiene
  - Need more focus on measurement and improvement
- Future studies of patient hand hygiene interventions should use stronger study designs

Next Steps

- Mixed methods study to assess patient HH knowledge/attitudes/practices
  - Quantitative survey of adult inpatients, followed by qualitative interviews of a sample of patients
- Implementation and evaluation of patient HH interventions

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Questions?

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