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Prevention and Control of Infections: The Practical Aspects

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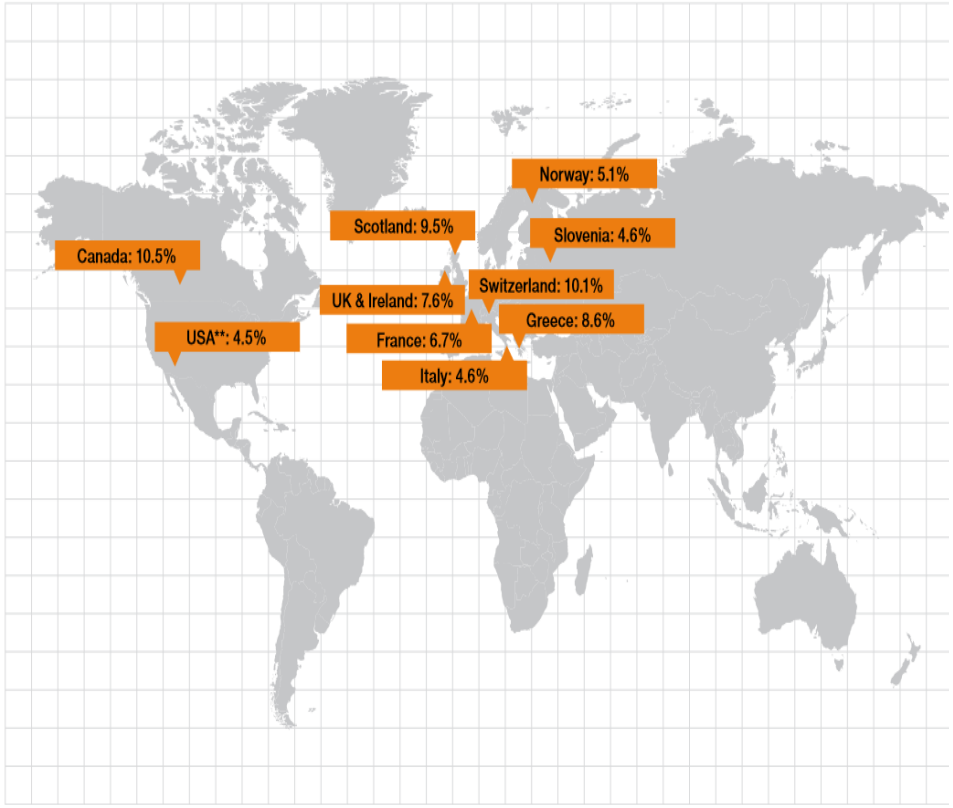
Global Burden of Healthcare Associated Infections (HAIs)

Prevalence of HCAI in developed countries*



* References can be found in Part I.3 of the *WHO Guidelines on Hand Hygiene in Health Care 2009*
**Incidence

Prevalence of HCAI in developing countries*

* References can be found in Part I.3 of the *WHO Guidelines on Hand Hygiene in Health Care 2009*

Let's put this into perspective..

HAIs in US
2006: 1.7m

Length of pages : 31,166 feet

Burj Khalifa: 2,717 feet high

Difference: 28,449 feet

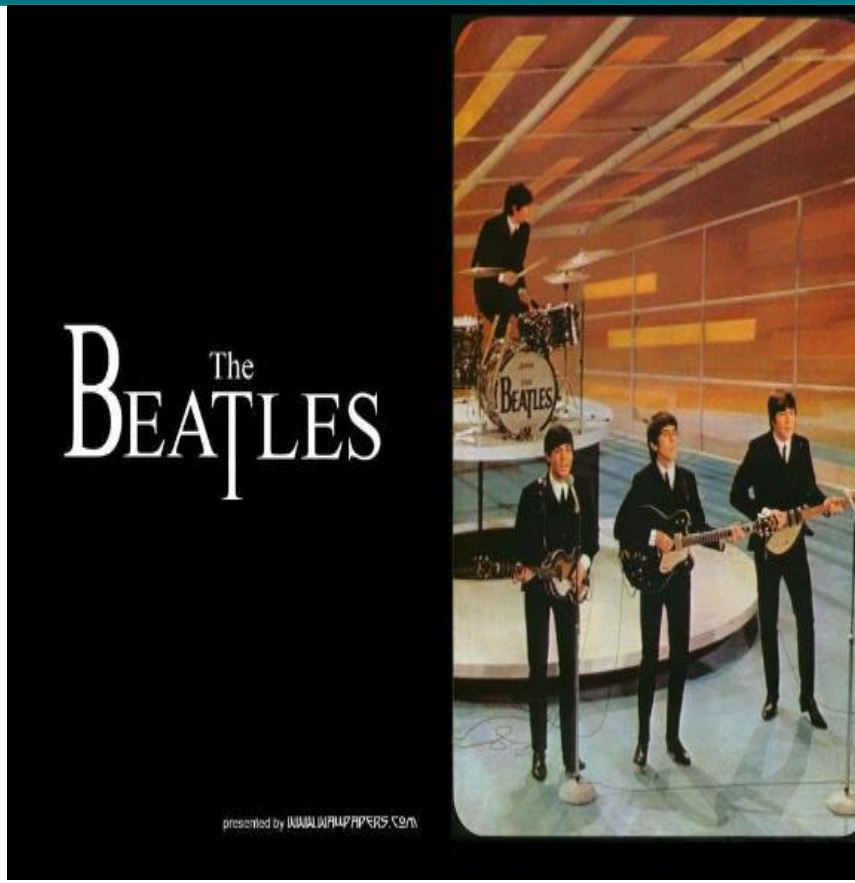
Data Source: Safe Care Campaign:http://www.safecarecampaign.org/facts.html

Objectives

- Practical issues related to Prevention and Control of healthcare-associated infections (HAIs).

Birth of Infection Prevention and Control Practitioners

- The 1950s: Staphylococcal infections were widespread in hospitals both in the UK and abroad.
- At Torbay it was felt that appointing a suitable nurse to a full-time position would control cross infections in patients.
- Brendan Moore, the first Infection Control Nurse (ICN) in the UK was appointed in April 1959.
- In 1963, Stanford University appointed Kathryn Wenzel as the first ICN in the USA.



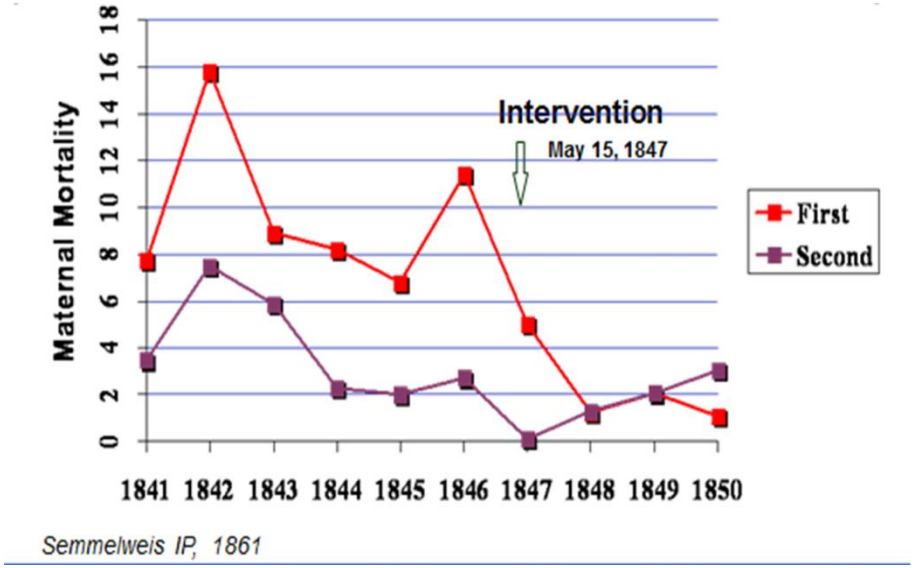
The ‘Pillars’ of the Prevention and Control of Infections

Leadership Commitment

- PCI.4 Hospital **leadership** provides resources to support the infection prevention and control program (JCI 6th edition).
- Get their buy in first.
- Speak to your leadership in terms of Costs savings, Patient Safety and Quality of Care in relation to HAIs.
- PCI-related KPIs in the CEO score cards.
- Assign Champions/Executive Sponsors from the C-Suite.

'Everything raises and falls through leadership' (John Maxwell).

Hand Hygiene and Infections: The Semmeilweis' Study (1841 – 1850).



Hand Hygiene and HAI Rates: 1970s – 2000s

Association between improved adherence with hand hygiene practice and health care-associated infection rates (1975– June 2008)

Year	Authors	Hospital setting	Major results	Duration of follow-up
1977	Casewell & Phillips[66]	Adult ICU	Significant reduction in the percentage of patients colonized or infected by Klebsiella spp.	2 years
1989	Conly et al.[81]	Adult ICU	Significant reduction in HCAI rates immediately after hand hygiene promotion (from 33% to 12% and from 33% to 10%, after two intervention periods 4 years apart, respectively)	6 years
1990	Simmons et al.[117]	Adult ICU	No impact on HCAI rates (no statistically significant improvement of hand hygiene adherence)	11 months
1992	Doebbeling et al.[118]	Adult ICUs	Significant difference between rates of HCAI using two different hand hygiene agents	8 months
1994	Webster et al.[74]	NICU	Elimination of MRSA when combined with multiple other infection control measures. Reduction of vancomycin use. Significant reduction of nosocomial bacteremia (from 2.6% to 1.1%) using triclosan compared to chlorhexidine for handwashing	9 months
1995	Zafar et al.[67]	Newborn nursery	Control of a MRSA outbreak using a triclosan preparation for handwashing, in addition to other infection control measures	3.5 years
2000	Larson et al.[119]	MICU/NICU	Significant (85%) relative reduction of the vancomycin-resistant enterococci (VRE) rate in the intervention hospital; statistically insignificant (44%) relative reduction in control hospital; no significant change in MRSA	8 months
2000	Pittet et al.[75,120]	Hospital-wide	Significant reduction in the annual overall prevalence of HCAI (42%) and MRSA cross-transmission rates (87%). Active surveillance cultures and contact precautions were implemented during same time period. A follow-up study showed continuous increase in handrub use, stable HCAI rates and cost savings derived from the strategy.	8 years
2003	Hilburn et al.[121]	Orthopaedic surgical unit	36% decrease of urinary tract infection and SSI rates (from 8.2% to 5.3%)	10 months
2004	MacDonald et al.[77]	Hospital-wide	Significant reduction in hospital-acquired MRSA cases (from 1.9% to 0.9%)	1 year
2004	Swoboda et al.[122]	Adult intermediate care unit	Reduction in HCAI rates (not statistically significant)	2.5 months
2004	Lam et al.[123]	NICU	Reduction (not statistically significant) in HCAI rates (from 11.3/1000 patient-days to 6.2/1000 patient-days)	6 months
2004	Won et al.[124]	NICU	Significant reduction in HCAI rates (from 15.1/1000 patient-days to 10.7/1000 patient-days), in particular of respiratory infections	2 years

Source: the WHO Hand Hygiene Guidelines in Healthcare settings, 2009

Hand Hygiene Program: The WHO Multi-modal Strategy

- System change: easy access to alcohol hand rubs.
- Training and Education
- Monitoring and feedback
- Visual reminders
- Creation of a Safety Climate.

Shall we continue to Monitor Hand Hygiene by looking at the Hand Hygiene Compliance Data alone?

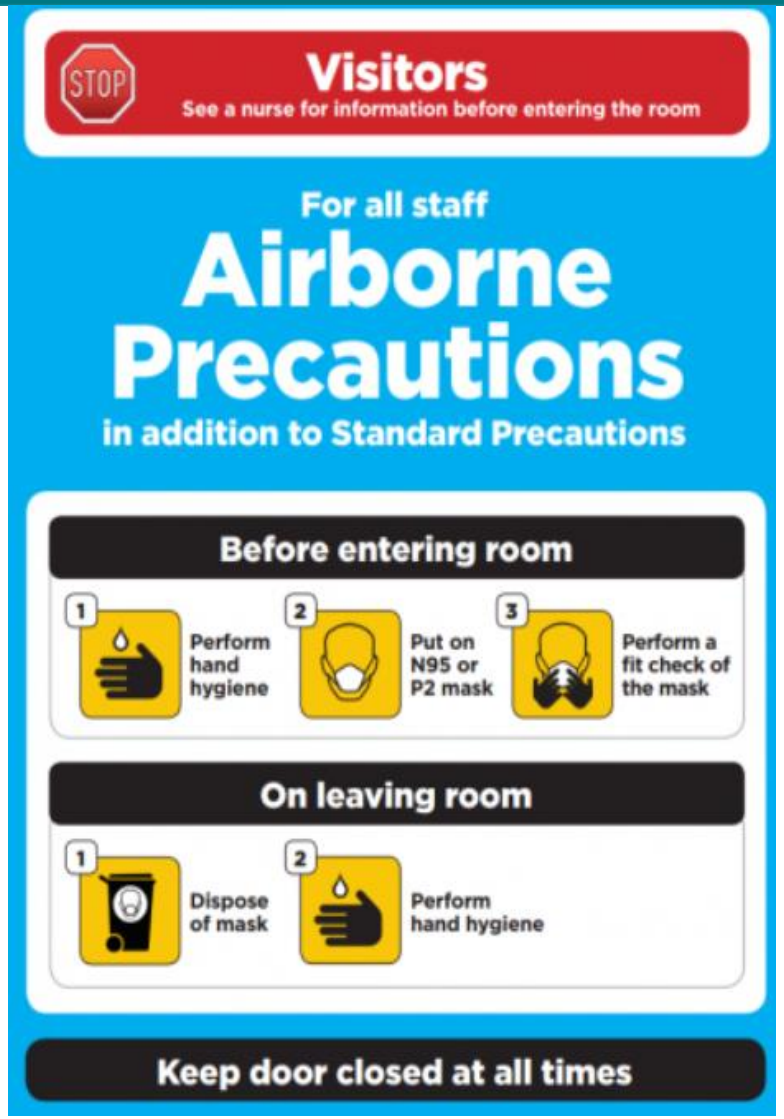
OR

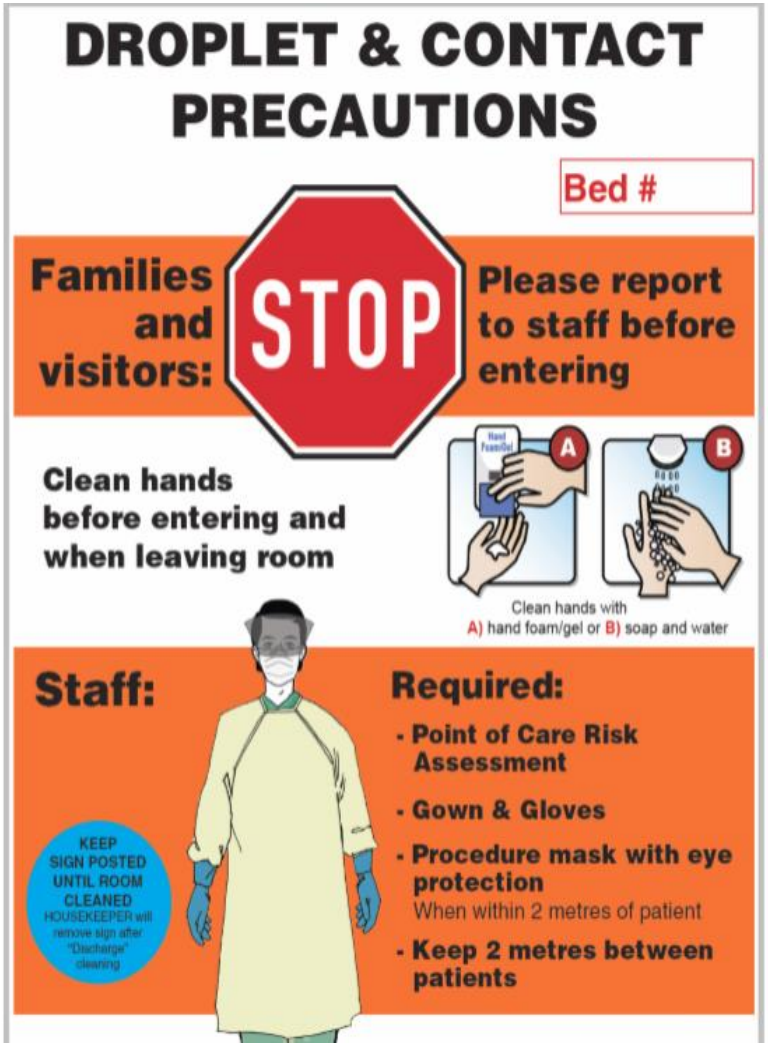
Shall we Measure Hand Hygiene by Measuring the Rate of Hands transmissible HAIs?

Hands Transmissible HAIs: Multi Drug Resistance Organisms (MDROs)

- Methicillin-resistant *Staphylococcus aureus (MRSA).*
- *Staphylococcus aureus* with Vancomycin Intermediate/Resistance (VISA/VRSA).
- Vancomycin-resistant *Enterococci* (VRE)
- Extended spectrum beta-lactamase-producing gram-negative bacilli (ESBLs).
- Multidrug-resistant *Streptococcus pneumoniae* (MDRSP).
- Carbapenem-resistant enterobacteriaceae (CRE).
- Multidrug-resistant *Acinetobacter.*
- *New kid on the block….**Candida auris***

Isolation and Barrier Precautions





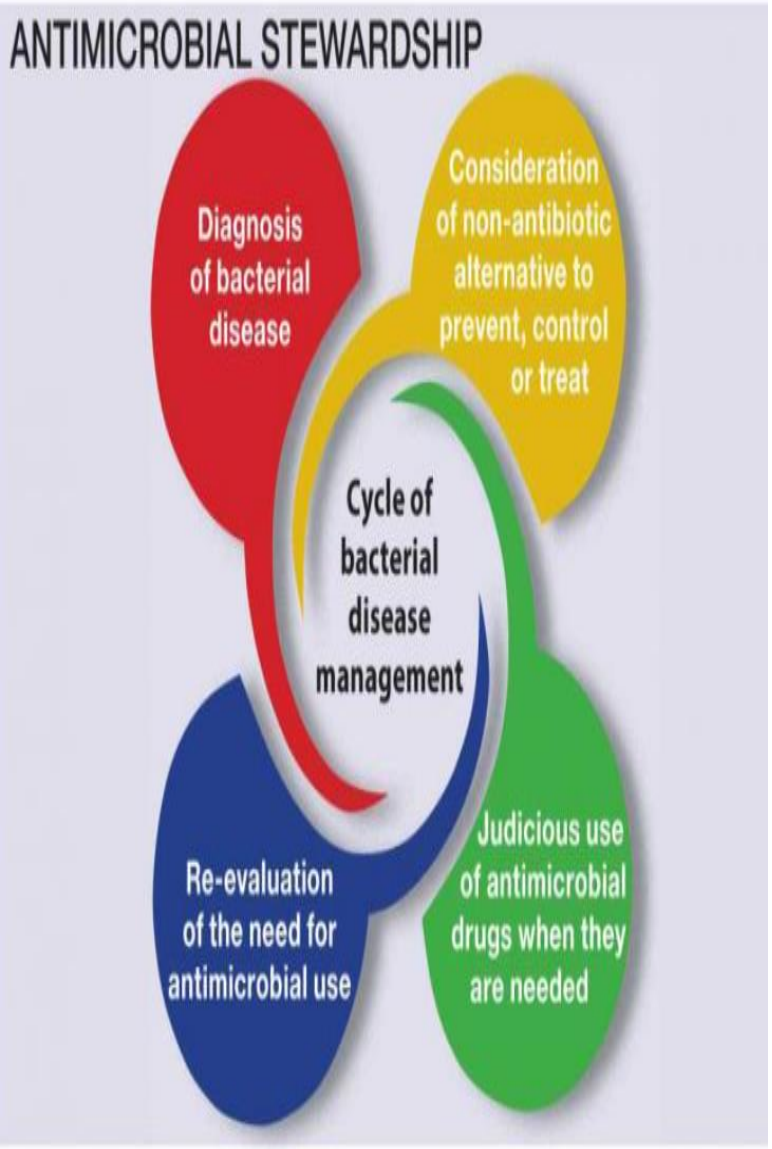
Isolation Precautions: When things go wrong….

- Healthcare workers, visitors and other patients exposure to Communicable Diseases.
- Outbreaks in healthcare settings.
- Disruption in the healthcare systems.
- Chaos……..

How to Prepare for Isolation: Plan ahead..

- Healthcare workers: Train them well.
- Develop Policies/Plans
- Availability of Isolation Rooms.
- Inventory check on PPE.
- Contingency when Airborne Isolation rooms are unavailable.
- Handling of Surge Capacity.
- Periodic Drills for Communicable Diseases

Prudent Use of Antimicrobials



Table

CDC's seven core elements of antimicrobial stewardship

1. Leadership commitment
2. Accountability
3. Drug expertise
4. Action
5. Tracking
6. Reporting
7. Education

Decontamination of Re-usable Equipment

Spaulding Classification

Patient Contact	Examples	Device Classification	Minimum Inactivation Level
Intact skin		Non-Critical	Cleaning and/or Low/Intermediate Level Disinfection
Mucous membranes or non-intact skin		Semi-Critical	High Level Disinfection
Sterile areas of the body, including blood contact		Critical	Sterilization

Challenges with HLD in Endoscopes and Bronchoscopes

Kovaleva et al.

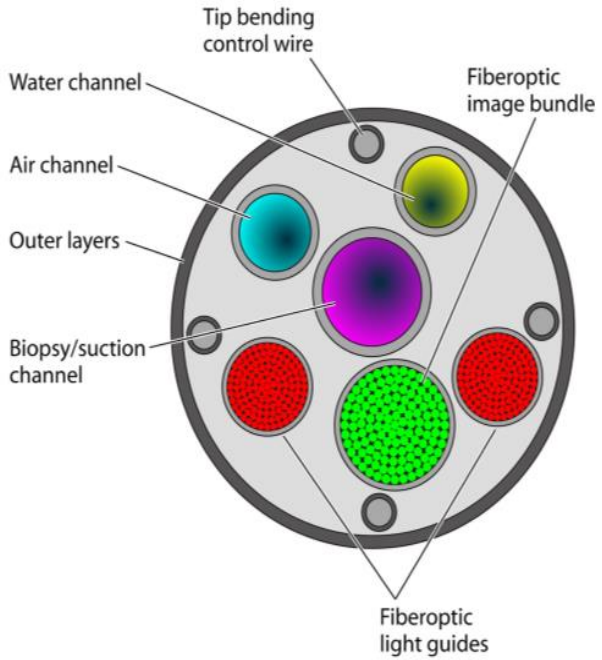


FIG 1 Schematic drawing of a cross section of a flexible endoscope showing the complex design and multiple internal channels (inner diameter, 2.8 to 3.8 mm).

Google

outbreaks related to endoscopy

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CDC Statement: Los Angeles County/UCLA investigation of ...

https://www.cdc.gov › hai › outbreaks › cdcstatement-la-cre

Design of **Endoscopic** Retrograde Cholangiopancreatography (ERCP) ... Investigators of previous **outbreaks** of CRE **related** to duodenoscopes have identified ...

CDC Confirms Superbug Transmission via Endoscopy

https://www.medscape.com › viewarticle

Jan 3, 2014 - CDC Confirms Superbug Transmission via **Endoscopy** ... The E. coli isolate was highly **related** (>95%) to the **outbreak** strain by [pulsed-field gel ...

Deadly bacteria on medical scopes trigger infections

https://www.usatoday.com › news › bacteria-deadly-endoscope-contamination

Jan 21, 2015 - CRE infection **linked** to medical device design ..... But public health officials and **endoscopy** experts who have studied the ... Muscarella has identified at least a half-dozen U.S. **outbreaks** of CRE and **related** superbugs since ...

Endoscopy-related infections found higher than expected ...

https://www.the-hospitalist.org › article › healthcare-acquired-infections › en

Infections-related to Endoscopic and Bronchoscopic Procedures

TABLE 4 Infections associated with endoscopic retrograde cholangiopancreaticography[a]

Reference	Microorganism(s)	No. of contaminated patients after endoscopy	No. of infected patients	Infection(s)	Detection of endoscope contamination	Cause(s) of contamination
95	*P. aeruginosa*	1	1	Cholangitis, sepsis	Yes	Inappropriate cleaning and disinfection (ethanol)
96	*P. aeruginosa*	14	0	No	Yes	Inappropriate cleaning and disinfection (povidone-iodine/ethanol)
97	*P. aeruginosa*	7	7	Cholangitis	Yes	Inappropriate cleaning and disinfection (ethanol)
100	*P. aeruginosa*	1	1	Sepsis	Yes	Contaminated water bottles
53	*P. aeruginosa*	4	3	Sepsis	Yes	Inappropriate disinfection; rinsing with nonsterile tap water
91	*P. aeruginosa*	5	5	Cholangitis, sepsis, urinary tract infection	Yes	Inadequate cleaning and disinfection between uses in patients (tap water)
22	*P. aeruginosa*	10	5	Cholecystitis, liver abscess	Yes	Contaminated AER; inappropriate cleaning and disinfection; drying with no ethanol flushing
328	*P. aeruginosa*	1	1	Liver abscess	No	Not found; endoscope reprocessing not described
98	*P. aeruginosa*	2	2	Sepsis	Yes	Inappropriate cleaning and disinfection (cetrimide)
90	*P. aeruginosa*	7	7	Bacteremia/sepsis, cholangitis, pancreatitis	Yes	Contaminated water bottle; inadequate manual cleaning and disinfection between patients (isopropanol)
99	*P. aeruginosa*	5	5	Sepsis	Yes	Contaminated water bottle (not disinfected)
23	*P. aeruginosa*	16	No data	Bacteremia/sepsis, cholangitis, pneumonia	Yes	Contaminated AER (a flaw in design, presence of biofilm); drying with no ethanol flushing
75	*P. aeruginosa*	25	25	Bacteremia/sepsis	Yes	Failure to disinfect elevator channel in AER; drying with no ethanol flushing
101	*P. aeruginosa*	5	3	Cholangitis, sepsis	No	Not found; endoscope reprocessing not described
29	*P. aeruginosa*	3	3	Sepsis	Yes	Contaminated water bottle; inadequate manual cleaning; insufficient disinfectant exposure
2	*P. aeruginosa*	3	3	Sepsis	Yes	Presence of biofilm in intact endoscope channels
83	*Salmonella* Oslo	3	2	Gastroenteritis, sepsis	Not tested	Inappropriate cleaning and disinfection (povidone-iodine/ethanol)
141	*Serratia marcescens*	1	0	No	Yes	Inappropriate cleaning and disinfection (povidone-iodine)
52	*M. chelonae*	14	0	No	No data	Contaminated AER; inappropriate disinfection; rinsing with tap water; lack of drying procedure
147	*Methylobacterium mesophilicum*	1	1	Bacteremia	Yes	Contaminated endoscope channels
144	ESBL-producing *K. pneumoniae*	16	12	Bacteremia/sepsis, cholangitis	Yes	Contaminated endoscope channels; insufficient drying procedure
145	KPC-producing *K. pneumoniae*	7	2	Bacteremia	Yes	Contaminated endoscope channels; insufficient drying procedure
184	HCV	1	1	HCV infection	Not tested	Inadequate disinfection (low concn, insufficient exposure); failure to perfuse elevator channel

Kovaleva et al (2018): Transmisison of infection by flexible Gastrointestinal Endoscopy and Bronchoscopy.

Decontamination of Environment

Does it Matter???

Table 1. Summary of survival time *versus* prior room occupancy risk for healthcare-associated infections.

Organism	Survival time*	Prior room occupancy risk increase[$]
MRSA	7 days to >12 months	1.5
VRE	5 days to >46 months	2.25
Pseudomonas aeruginosa	6 h to 16 months	1.75
Clostridium difficile	>5 months (spores)	2.5
Acinetobacter baumannii	3 days to 11 months	3.5
CRE	19 days	
Norovirus (feline calicivurus)	8 h to 7 days	Limited data
Rotavirus	6–60 days	Limited data

Adapted from Kramer *et al.* [2006], Otter *et al.* [2013], and Havill *et al.* [2014].
*Survival times of multidrug-resistant organisms (MDROs) on dry inanimate objects. Range depends on experimental design and methods of assessing contamination.
[$]Ratio of increased risk associated with the room being previously occupied by patients infected with common MDROs.

Prevention of Devices-related infections

- CAUTI
- CLABSI/CR-BSI
- VAE/VAP

Prevention of Device Related Infections

The First Two Bundles

IHI Ventilator Bundle

- 1. Elevation of the head of the bed to between 30 and 45 degrees
- 2. Daily "sedation vacations" and assessment of readiness to extubate
- 3. Peptic ulcer disease (PUD) prophylaxis
- 4. Deep venous thrombosis (DVT) prophylaxis
- (Note: A fifth bundle element, "Daily oral care with chlorhexidine," was added in 2010.)

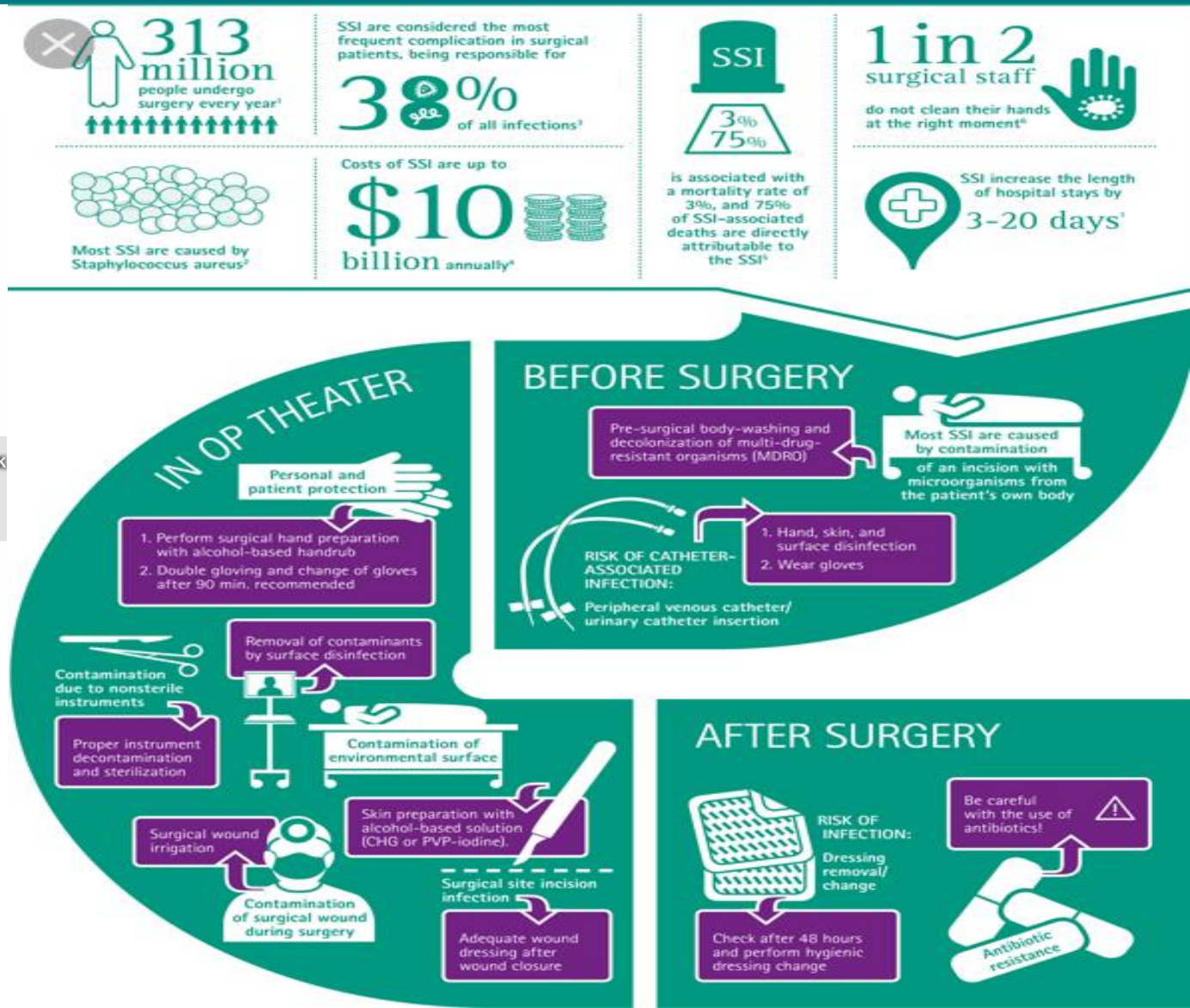
IHI Central Line Bundle

- 1. Hand hygiene
- 2. Maximal barrier precautions
- 3. Chlorhexidine skin antisepsis
- 4. Optimal catheter site selection, with avoidance of using the femoral vein for central venous access in adult patients
- 5. Daily review of line necessity, with prompt removal of unnecessary lines

The CAUTI Bundle:

- Hand Washing
- Avoid unnecessary urinary Catheters
- Insert urinary catheters using aseptic technique
- Maintain urinary catheters based on recommended guidelines
- Review urinary catheter necessity daily

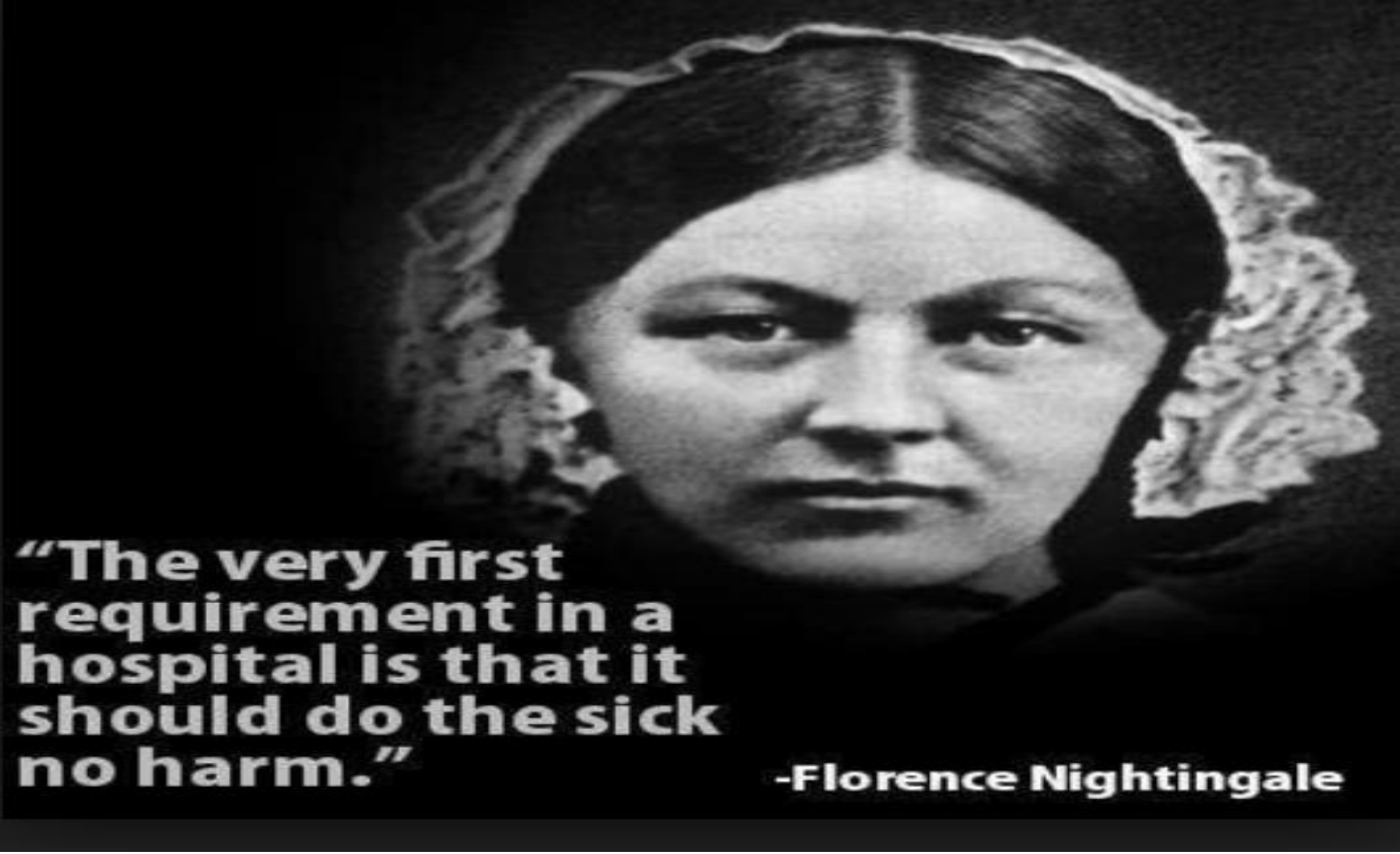
Surgeries and Surgical Site Infections (SSIs)



A Bundle Approach to SSI: Surgical Care Improvement Program (SCIP).

CURRENT SCIP MEASURES

- **SCIP-1** Pre-op Antibiotic given within 1 hr. before incision
- **SCIP-2** Must receive SCIP recommended prophylactic antibiotic
- **SCIP-3** Discontinue antibiotic within 24 hrs. of anesthesia end time (cardiac op exception)
- **SCIP-4** Controlled 6 am postoperative serum glucose (cardiac only)
- **SCIP-6** Appropriate hair removal
- **SCIP-CARD-2** Perioperative beta-blocker therapy for pre B blocker Rx
- **SCIP-VTE-2** VTE prophylaxis within 24 hrs. prior to or after anesthesia end time
- **SCIP-9** Remove urinary catheter by postop day 2
- **SCIP-10** Temperature >96.8 F- 15 min. after anesthesia end time



Thanks for your attention!!