Measures to be taken: hand hygiene, isolation, hospital cleaning

Benedetta Allegranzi

Clean Care is Safer Care
WHO Patient Safety

21st ECCMID / 27th ICC, Milan, Italy, 7-10 May 2011
Trends of decreases in *S. aureus* bacteremia cases caused by MRSA in 10 countries (EARSS, 2005–2008)
National strategies - key components (1999-2007)

<table>
<thead>
<tr>
<th>Type of intervention</th>
<th>Belgium</th>
<th>England</th>
<th>France</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structural</td>
<td>Antimicrobial stewardship teams (2002); funding of infection control practitioners and antibiotic managers (2002); national and regional infection control coordination structures (2000)</td>
<td>Department of Health Improvement team visits (2005)</td>
<td>Prudent antimicrobial use and hospital antibiotic use committees (2002)</td>
</tr>
</tbody>
</table>

**Note.** CEO, chief executive officer; NHS, National Health Service, England.

<table>
<thead>
<tr>
<th>IC measure</th>
<th>ICUs (n=256) (%)</th>
<th>SDs (n=223) (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bed-side ABHR availability</td>
<td>85</td>
<td>59</td>
</tr>
<tr>
<td>Isolation</td>
<td>84</td>
<td>87</td>
</tr>
<tr>
<td>Barrier precautions</td>
<td>94</td>
<td>93</td>
</tr>
<tr>
<td>MRSA pts decolonization with mupirocin</td>
<td>63</td>
<td>71</td>
</tr>
<tr>
<td>MRSA pts washing with CHL</td>
<td>66</td>
<td>75</td>
</tr>
<tr>
<td>Routine screening of potential MRSA pts</td>
<td>75</td>
<td>72</td>
</tr>
<tr>
<td>Routine screening of pts admitted from other wards or H</td>
<td>51</td>
<td>24</td>
</tr>
<tr>
<td>Routine screening of pts admitted from other countries</td>
<td>44</td>
<td>24</td>
</tr>
<tr>
<td>Routine screening of pts admitted from LTCFs</td>
<td>58</td>
<td>35</td>
</tr>
</tbody>
</table>

ICUs = intensive care units. SDs = surgical departments. ABHR = alcohol-based handrub. CHL = chlorexidine. LTCFs = Long-term care facilities.

* HELICS study from 10 countries

Hansen S et al. Infection 2010
IC strategies for HA-MRSA in USA

- APIC survey in 2006
- Hospital-wide
- 1237 respondents
- **Contact isolation:** > 72%
- **Screening:**
  - any routine screening: 29%
  - pts admitted from LTCF: 42%
  - pts admitted from other HCF: 33%
  - repeated admissions: 20%

*Jarvis et al. Am J Infect Control 2007*
Figure 1: Lazzaretto Nuovo in the 16th–18th century

The Lazzaretto Vecchio, the first isolation institution worldwide, was established on the island of Saint Mary of Nazareth (later renamed Lazzaretto Nuovo) in Venice in 1423 to limit the spread of plague (from which the name “Lazzaretto” originated). In 1468, the Venetian Senate designated Lazzaretto Nuovo as a quarantine island and huge warehouses were erected to store merchandise arriving in Venice from suspect areas with merchants and sailors quartered alongside. Reprinted with permission from Vanzan Marchini NE. I recinti della peste. In: Rotte Mediterranee e Baluardi di Sanità. Geneva Milan: Skira Editore SpA, 2004: 207.

Pittet D et al. Lancet Infect Dis 2005
Slide withheld at request of author
Strategies to Prevent Transmission of Methicillin-Resistant Staphylococcus aureus in Acute Care Hospitals

Supplement Article: SHEA/IDSA Practice Recommendations for the Prevention of Healthcare-Associated Infections

Contact Precautions

ESCMID Online Lecture Library

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Isolation of patients in single rooms or cohorts to reduce spread of MRSA in intensive-care units: prospective two-centre study

Jorge A. Cepeda, Tony Whitehouse, Ben Cooper, Janeane Halls, Karen Jones, Felicia Kwaku, Lee Taylor, Samantha Hayman, Barry Cookson, Steve Shaw, Chris Kibbler, Mervyn Singer, Geoffrey Bellington, A Peter R. Wilson

- 1-year prospective study from June 2001 in 3 MS-ICUs of 2 teaching hospital in London
- Phase 1 (first 3 months) and phase 3 (last 3 months): any MRSA colonised or infected patient was moved to a single room or cohort-isolated with other MRSA patients (move phase)
- Phase 2: no move of MRSA patients (unless carrying other MDR or notifiable pathogens, or needed protective isolation)
- In all phases: standard and contact precautions; regular environmental cleaning; regular HH education; dedicated equipment in isolation rooms
- Ethics approval with no need of patient consent because "no compelling evidence was available to adopt one or other practice..."
Cepeda J et al. Lancet 2005 – Results

- No evidence that moving MRSA-positive patients into single rooms or cohorted bays was associated with a reduction in cross-infection, overall and in both hospitals

- Hazard ratio for MRSA acquisition during Phase 2 (non-move) = 0.79 (0.51–1.22) (Cox proportional-hazards model)
To isolate or not to isolate?

- 164 ICUs (77.4% of KISS)
- Survey conducted in 2001 and referring to 1997-2001
- 34.4% of the German ICUs did not isolate MRSA patients in private rooms or cohorts

**TABLE 4**

**RESULTS OF THE LOGISTIC REGRESSION ANALYSIS**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Odds Ratio</th>
<th>CI&lt;sub&gt;95&lt;/sub&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Routine isolation in private rooms (or cohorts)</td>
<td>0.36</td>
<td>0.17–0.79</td>
</tr>
<tr>
<td>Surgical intensive care unit</td>
<td>2.96</td>
<td>1.34–6.57</td>
</tr>
</tbody>
</table>

CI<sub>95</sub> = 95% confidence interval.

Gastmeier P et al. ICHE 2004
Single rooms may help to prevent nosocomial bloodstream infection and cross-transmission of methicillin-resistant *Staphylococcus aureus* in intensive care units.

The incidence density of MRSA acquisition:

- 4.1 [95% CI 2.7–6.3]/1,000 patient-days in bay rooms
- 1.3 [0.5–3.4]/1,000 patient-days in single rooms
Antimicrobial drug use and infection control practices associated with the prevalence of methicillin-resistant *Staphylococcus aureus* in European hospitals

F. M. MacKenzie¹, J. Bruce², M. J. Struelens³, H. Goossens⁴,⁵, J. Mollison² and I. M. Gould² on behalf of the ARPAC Steering Group*

- Observational, retrospective, cross-sectional study in 2002
- Data from 146 hospitals
- Adjusted* regression modelling, strong predictors:
  - placement of MRSA patients in single rooms (mean difference -11.2%, 99% CI 1.4–20.9)
  - higher resistance levels in hospitals with problems in implementing isolation policies (mean difference 12%, 99% CI 3.8–20.1)
  - use of alcohol-based hand rubs (mean difference -10.3 %, 99% CI 1.2–10.3)

*Adjusted for antibiotic consumption, case-mix, hospital size, teaching status and geographical variations.
The Role of Gowns in Preventing Nosocomial Transmission of Methicillin-Resistant *Staphylococcus aureus* (MRSA): Gown Use in MRSA Control

J. Grant, MDCM, FRCPC; L. Ramman-Haddad, BScN, CIC; N. Dendukuri, PhD; M. D. Libman, MDCM, FRCPC

During a 2-year period, a standard isolation protocol for control of methicillin-resistant *Staphylococcus aureus* was compared with a similar protocol in which gowns were not used but the availability of alcohol-based hand disinfectant was increased. Intervention wards had 0.16 fewer new MRSA transmissions per ward per month, compared with control wards (*P* was not significant).

*Infect Control Hosp Epidemiol* 2006; 27:191-194
Key points on hand hygiene and glove use

- Indications for glove use do not modify any indication for hand hygiene

- Glove use does not replace any hand hygiene action
Ethical and psychological considerations

- Adverse effects of social isolation
- Patient satisfaction
- Level of care provided to pts in isolation
- Ethical considerations:
  - Balance between pt autonomy versus protection of the population
  - Need for informed consent for obtainment of active surveillance cultures?
  - Who pays?

Morgan et al. Am J Infect Control 2009
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Environmental cleaning?
Management of Multidrug-Resistant Organisms in Healthcare 2006

Guidelines for the control and prevention of meticillin-resistant Staphylococcus aureus (MRSA) in healthcare facilities

J.E. Coia a, G.J. Duckworth b, D.I. Edwards c, M. Farrington d, C. Fry e, H. Humphreys f,*, C. Mallaghan g, D.R. Tucker h, for the Joint Working Party of the British Society of Antimicrobial Chemotherapy, the Hospital Infection Society, and the Infection Control Nurses Association

Environmental decontamination
Contribution of contaminated surfaces to transmission

- MRSA resists desiccation and can survive in hospital dust for up to a year
- Molecular fingerprinting of these strains shows that MRSA-positive patients tend to shed their own strain of MRSA into the near-patient environment
- MRSA can be found on general surfaces such as floors and radiators, furniture such as beds and lockers, and clinical equipment. Linen, curtains, beds, lockers and overbed tables, tend to harbour MRSA more frequently than others
- It is thought that contamination of near-patient hand-touch sites provides the biggest risk of MRSA acquisition for patients

_Dancer S. J Hosp Infect 2009_
Pittet D et al. The Lancet Infect Dis 2006
Suboptimal cleaning practices

- Terminal cleaning of rooms after patient discharge is often inadequate (Carling PC et al. Clin Infect Dis 2006; Eckstein BC et al. BMC Infect Dis 2007)

- Only 47% of surfaces targeted for terminal cleaning had been cleaned (Carling PC et al)

- Patients admitted to a room formerly occupied by a patient with VRE or MRSA are at increased risk of acquiring the organism
  - Patients acquire the organism directly from contaminated surfaces from HCWs who contaminate their hands in the room

Martinez JA et al. Arch Intern Med 2003
Huang SS et al. Arch Intern Med 2006
Would concentrating available resources on enhanced cleaning and in particular high-risk hand-touch sites be the most cost-effective strategy?

No study available on cost-effectiveness…

What is the experience with educational campaigns and feedback on adequacy of discharge cleaning?
Common Agents Used for Disinfection of Environmental Surfaces

Chlorine and Chlorine compounds
- Sodium hypochlorite (5.25 – 6.15% solutions – “bleach”)
- Sodium dichloroisocyanurate tablets
- Demand-release chlorine dioxide, chloramine-T

Ethyl or isopropyl alcohol (70-90%)

Quaternary ammonium germicidal solutions

Phenolic germicidal detergent solutions

Iodophor germicidal solutions

Accelerated hydrogen peroxide solutions
Environmental decontamination of a hospital isolation room using high-intensity narrow-spectrum light

Room Decontamination with UV Radiation

William A. Rutala, PhD, MPH; Maria A. Matuschek

Impact of Hydrogen Peroxide Vapor Room Decontamination on Clostridium difficile Environmental Contamination and Transmission in a Healthcare Setting

John M. Boyce, MD; Nancy L. Havill, MT; Jonathan A. Otter, BSc; L. Clifford McDonald, MD; Nicholas M. T. Adams, BSc; Timothea Cooper, RN; Angela Thompson, MSc; Lois Wiggs; George Killgore, DrPH; Allison Tauman, PharmD; Judith Noble-Wang, PhD
Routine disinfection of patients’ environmental surfaces. Myth or reality?

S. Dharan*, P. Mourouga*, P. Copin*, G. Bessmer†, B. Tschanz† and D. Pittet*

*Infection Control Programme, †Service Propreté-Hygiène, University Hospitals of Geneva, Switzerland


- 1’117 patients
- No change in the incidence of nosocomial infections during the four months of the trial
- Routine disinfection of environmental surfaces does not necessarily make it safer for the patient and could seed the environment with potential pathogens.
Does disinfection of environmental surfaces influence nosocomial infection rates? A systematic review

Markus Dettkenkoffer, MD,a Sibylle Wenzler, MDa Susanne Amthor,a Gerd Antwis, PhD,b Edith Motschall,c and Franz D. Daschner, MDa
Freiburg, Germany

- 236 scientific articles reviewed
- 4 cohort studies (no RCT)
- None showed lower infection rates with routine disinfection of surfaces (mainly floors) vs. cleaning with detergents only

(Am J Infect Control 2004;32:84-9.)

World Health Organization

Patient Safety
A World Alliance for Safer Health Care

SAVE LIVES
Clean Your Hands
Does hospital cleanliness correlate with meticillin-resistant *Staphylococcus aureus* bacteraemia rates?

D. Green\(^a,\ast\), N. Wigglesworth\(^b\), T. Keegan\(^a\), M.H. Wilcox\(^b,c\)

- Publicly available data from all NHS hospitals in England
- No consistent relationship between hospital cleanliness (PEAT scores) and the incidence of MRSA bacteraemia

- While a high standard of hospital cleanliness is a worthwhile goal, it is not helpful to link MRSA control measures with improvements in standards of environmental cleanliness

*Green et al. J Hosp Infect 2006*
**Setting:** ICU rooms in an academic hospital

**Intervention:**
1) Increasing the volume of disinfectant applied to environmental surfaces
2) Education for Environmental Services staff
3) Feedback with a black-light marker

**Results:**
1) Reduction of the likelihood of an environmental culture positive for MRSA or VRE (proportion of cultures positive, 45% at baseline vs 27% during the intervention; adjusted odds ratio, 0.4; \( P = .02 \))
2) Broad, flat surfaces were more likely to be cleaned than were doorknobs and sink and toilet handles
1-year cross-over study introducing an additional cleaner into 2 matched wards from Monday to Friday for 6 months

Ten hand-touch sites on both wards were screened weekly and patients were monitored for MRSA infection

Enhanced cleaning was associated with a 32.5% reduction in levels of microbial contamination at hand-touch sites ($P < 0.0001$: 95% Cl 20.2%, 42.9%)

26.6% reduction in new MRSA infections on the wards receiving extra cleaning ($P = 0.032$: 95% Cl 7.7%, 92.3%)

Enhanced cleaning saved the hospital £30,000 to £70,000.
1-year prospective randomized crossover study

In each of six 2-month periods, one unit was randomly selected for additional twice-daily enhanced cleaning of hand contact surfaces

Agar contact samples taken at five sites around randomly selected bed areas, from staff hands and communal sites

Reduction of:
- environmental MRSA per bed-area day reduced during enhanced cleaning phases from 82 of 561 (14.6%) to 51 of 559 (9.1%) (adjusted odds ratio, 0.59; 95% CI, 0.40–0.86; \( p = .006 \))
- MRSA contamination on doctors’ hands during enhanced cleaning (3 of 425; 0.7% vs. 11 of 423; 2.6%; adjusted odds ratio, 0.26; 95% CI, 0.07–0.95; \( p = .025 \))

- No significant effect on patient MRSA acquisition (adjusted odds ratio, 0.98; 95% confidence interval, 0.58–1.65; \( p = .93 \))
Environmental cleaning - conclusions

- There is clear evidence that regular cleaning is not optimally performed
- RCTs are needed to assess the impact of environmental cleaning on MRSA transmission and infection
- Probably, enhanced cleaning is not the priority but regular cleaning optimization
The patient zone and the contacts occurring within it.
Step 2:
Patient germs contaminate HCW hands by direct and indirect contact

- Risk varies – type and duration of patient care, location etc
- Glove contamination similar to hand contamination
- Gloving does not fully protect hands from contamination

“Clean” activities (lifting patients, taking the patient's pulse etc) contaminated hands with 100–1,000 CFU of Klebsiella spp.

In a general health-care facility, 29% nurses carried *S. aureus* on their hands and 17–30% GNB.

Step 5:
Germ cross-transmission between patient A and patient B, devices and environment via hands

Transmissibility depends on type of surface, inoculum load, moisture level of surface, microorganism etc

Pittet D et al. The Lancet Infect Dis 2006
The geographical conceptualization of the transmission risk
Site with infectious risk for the patient
Site with exposure to body fluids
The risk of germs transmission and the indication for hand hygiene

Indication

Risk of transmission

After hands contact with a surface (A)

Before hands contact with a surface (B)
The My Five Moments approach

Making it easier to

■ understand
■ remember
■ practice

the hand hygiene indications at the point of care

My 5 moments for
HAND HYGIENE

1. BEFORE TOUCHING A PATIENT
2. BEFORE CLEAN/ASEPTIC PROCEDURE
3. AFTER BODY FLUID EXPOSURE RISK
4. AFTER TOUCHING A PATIENT
5. AFTER TOUCHING PATIENT SURROUNDINGS

# Impact of hand hygiene promotion on MRSA infections

<table>
<thead>
<tr>
<th>Year</th>
<th>Authors</th>
<th>Setting</th>
<th>Hand hygiene (HH) compliance increase</th>
<th>Impact on MRSA infection</th>
<th>Follow-up duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>Larson E et al</td>
<td>MICU/NICU</td>
<td>NA</td>
<td>No significant change in MRSA</td>
<td>8 months</td>
</tr>
<tr>
<td>2000</td>
<td>Pittet D et al</td>
<td>Hospital-wide</td>
<td>From 48% to 66%</td>
<td>Significant reduction in the annual overall prevalence of HAI (42%) and MRSA cross-transmission rates (87%).</td>
<td>8 years</td>
</tr>
<tr>
<td>2004</td>
<td>MacDonald A et al</td>
<td>Hospital-wide</td>
<td>NS increase of HH compliance</td>
<td>Significant reduction in MRSA cases (from 1.9% to 0.9%)</td>
<td>1 year</td>
</tr>
<tr>
<td>2005</td>
<td>Johnson et al</td>
<td>Hospital-wide</td>
<td>From 21% to 42%</td>
<td>Significant reduction (57%) in MRSA bacteraemia</td>
<td>36 months</td>
</tr>
<tr>
<td>2008</td>
<td>Grayson ML et al</td>
<td>1) 6 pilot hospitals 2) all public hospitals in Victoria (Australia)</td>
<td>1) From 21% to 48% 2) From 20% to 33%</td>
<td>Significant reduction of MRSA bacteraemia and of clinical MRSA isolates</td>
<td>1) 2 years 2) 1 year</td>
</tr>
<tr>
<td>2008</td>
<td>Cromer AL et al</td>
<td>Hospital-wide</td>
<td>From 72.5% to 90.3%*</td>
<td>Significant reduction in MRSA from 0.85 to 0.52 per 1000 patient-days</td>
<td>10 months</td>
</tr>
<tr>
<td>2009</td>
<td>Lederer JW et al</td>
<td>Hospital-wide, seven acute care facilities</td>
<td>From 49% to 98% with sustained rates greater than 90%</td>
<td>Significant reduction of MRSA rates from 0.52 episodes per 1000 pt-days to 0.24 per 1000 pt-days</td>
<td>3 yrs</td>
</tr>
<tr>
<td>2009</td>
<td>McLaws et al</td>
<td>Hospital-wide in 208 public hospitals (statewide)</td>
<td>From 47% to 61%</td>
<td>Significant reduction of 6% of overall MRSA infections/10,000 patient-days. Reductions of 16% in MRSA infection in non-sterile sites in ICU and of 25% in sterile sites in non-ICU wards</td>
<td>18 months</td>
</tr>
<tr>
<td>2010</td>
<td>Cheng VCC et al</td>
<td>Adult ICU</td>
<td>From 29% to 64%</td>
<td>Significant reduction of incidence density of ICU onset bacteraemic and non bacteraemic MRSA infection</td>
<td>3 yrs (follow up from Phase 2)</td>
</tr>
</tbody>
</table>
Reduction of annual attack rate of MRSA

Overall incidence of MRSA infections decreased from 2.16 to 0.93 episodes per 10,000 patient-days

Pittet et al, Lancet 2000

Y.-C. Chuang\textsuperscript{a}, Y.-C. Chen\textsuperscript{b,c,d,*}, S.-C. Chang\textsuperscript{b,c,d}, C.-C. Sun\textsuperscript{c}, Y.-Y. Chang\textsuperscript{c}, M.-L. Chen\textsuperscript{c}, L.-Y. Hsu\textsuperscript{b,c}, J.-I. Wang\textsuperscript{b,c}

HH Culture-Change Program

Components:
- Executive commitment – hospital, State, national
- Alcohol-based hand-rub
- Alcohol wipes for shared equipment (not mandated)
- Education – HCWs, patients & relatives
- HCW empowerment & engagement (talking walls, gimmicks)
- Clear outcome measures
- Publicity – open reporting of good and bad results

Measurement
HH compliance
ABHRS usage data (monthly)
Rates of methicillin-resistant S. aureus (MRSA) disease:
- HCA-MRSA bacteremia per 100 patient discharges (100 PDs) (monthly)
- HCA-MRSA isolates per 100 pt days (monthly)
MRSA isolates and patient-episodes of bacteraemia

After 36 months:

**Total MRSA isolates:**
- 40% reduction (95% CI, 23%–58%)
- 1008 fewer clinical isolates

**Patients with MRSA bacteraemia:**
- 57% reduction in monthly rate (95% CI, 38%–74%)
- 53 fewer bacteraemias than expected (95% CI, 36–68 episodes)

Significant reductions of MRSA bacteraemia following hand hygiene promotion


Compliance increase from 21% to 47%

65 (95% CI: 5-126) fewer patients with MRSA bacteraemia in the 6 Pilot hospitals than expected prior to the intervention

HHCCP = hand hygiene culture-change program. * Mean HH compliance increased 24 months of the pilot study (P < 0.001).

HHCCP = hand hygiene culture-change program. MRSA = methicillin-resistant Staphylococcus aureus. * A statistically significant reduction in bacteraemias was noted at 24 months after the start of the intervention (P = 0.035 for trend).
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State-wide - MRSA bacteraemia

8 Statewide roll-out: patients with MRSA bacteraemia per 100 patient discharges (PD) per month before and after introduction of the HHCCP*

HHCCP = hand hygiene culture-change program. MRSA = methicillin-resistant Staphylococcus aureus.
* The number of patients with MRSA bacteraemia per 100 PD fell from 0.032 to 0.011 before the intervention to 0.012 at 12 months after the start of the intervention (P = 0.09 for trend).

State-wide - MRSA isolates

9 Statewide roll-out: total clinical MRSA isolates per 100 patient discharges (PD) per month before and after introduction of the HHCCP*

HHCCP = hand hygiene culture-change program. MRSA = methicillin-resistant Staphylococcus aureus.
* During the 24 months before the introduction of the HHCCP there was a significant reduction in rate of MRSA isolates per 100 PD per month (P = 0.0003 for trend). After the start of the intervention, the rate continued to decline, falling to a rate of 0.30/100 PD per month after 12 months (P = 0.043 for trend).

Antimicrobial drug use and infection control practices associated with the prevalence of methicillin-resistant *Staphylococcus aureus* in European hospitals

F. M. MacKenzie\(^1\), J. Bruce\(^2\), M. J. Struelens\(^3\), H. Goossens\(^4\)\(^5\), J. Mollison\(^2\) and I. M. Gould\(^2\) on behalf of the ARPAC Steering Group*

- **Observational, retrospective, cross-sectional study in 2002**
- **Data from 146 hospitals**
- **Adjusted* regression modelling, strong predictors:**
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  - placement of MRSA patients in single rooms (mean difference -11.2%, 99% CI 1.4–20.9)
  - higher resistance levels in hospitals with problems in implementing isolation policies (mean difference 12%, 99% CI 3.8–20.1)

*Adjusted for antibiotic consumption, case-mix, hospital size, teaching status and geographical variations.
An increase in alcohol-based handrub consumption correlated significantly with an improvement in the MRSA situation ($r = 0.78$)

Significant reduction of Methicillin-resistant S. aureus burden in 38 French hospitals (1993-2007)

- Following the launch of the ABHR campaign the consumption of ABHR increased regularly from 2000 to 2007 (2 to 21 L per 1000 HD)
- In acute care hospitals, MRSA rate decrease was sharper after the launch of the ABHR campaign (-2% vs -4.7% per year)

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MRSA trends, Acute Care, Belgium

Surveillance periods

- Resistance proportion
- n-MRSA incidence

Mean of rates in cohort of hospitals with min. 5

Source: Jans et al IPH surveillance report
Adoption of Alcohol-Based Hand Rubs by Belgian Hospitals, 1991-2006

Hand hygiene – conclusion

- There is clear evidence on hand transmission
- There is evidence demonstrating that hand hygiene improvement reduces HAI, including MRSA infection, at the institutional and national level

BUT...WE NEED:
- Cluster-randomized, controlled and/or stepped-wedge studies and/or mathematical models to:
  - better explore the relationship between hand hygiene compliance and the ultimate outcomes of HAI and the spread of antimicrobial resistance
  - assess the key features of a promotional campaign necessary for short-term and sustained improvement
- Qualitative research to better understand hand hygiene behaviour
MRSA prevention is complex
Thank you

WHO Clean Care is Safer Care

S A V E  L I V E S:

Clean Your Hands

5 MAY 2011

Where do YOU stand on hand hygiene?

Find all information at www.who.int/gpsc/5may
Send enquiries to savelives@who.int