14th European Patients' Rights Day

XIV EUROPEAN PATIENTS' RIGHTS DAY

ONE health approach, MULTIPLE answers:
Citizens' engagement & stakeholders' actions to tackle antimicrobial resistance and sustain EU progress

DIGITAL CONFERENCE
18th & 19th November 2020

# REDUCING HEALTHCARE-ASSOCIATED INFECTIONS INCIDENCE BY A PROBIOTIC-BASED SANITATION SYSTEM: A MULTICENTRE, PROSPECTIVE, INTERVENTION STUDY

Luca Arnoldo

# Introduction

1. Air pollution and climate change
2. Non communicable diseases (NCDs)
3. Global influenza pandemic
4. Fragile and vulnerable settings
5. **Antimicrobial resistance**
6. Ebola and other high-threat pathogens
7. Weak primary healthcare
8. Vaccine hesitancy
9. Dengue
10. HIV

Figure 4. *Klebsiella pneumoniae*. Percentage of invasive isolates resistant to third-generation cephalosporins (cefotaxime or/and ceftriaxone or/and ceftazidime), by country, EU/EEA, 2019

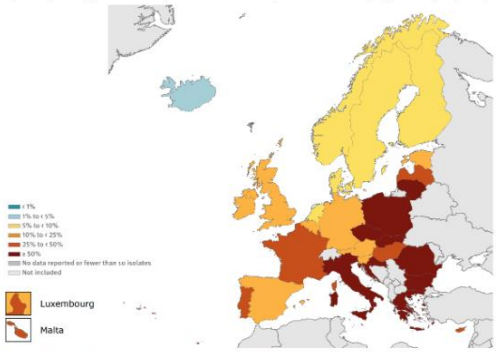



Figure 5. *Klebsiella pneumoniae*. Percentage of invasive isolates resistant to carbapenems (imipenem or/and meropenem), by country, EU/EEA, 2019

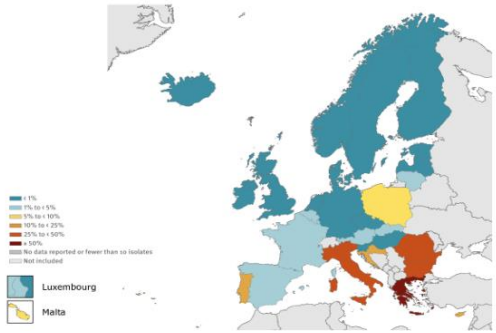



Figure 6. *Pseudomonas aeruginosa*. Percentage of invasive isolates with resistance to carbapenems (imipenem or/and meropenem), by country, EU/EEA, 2019

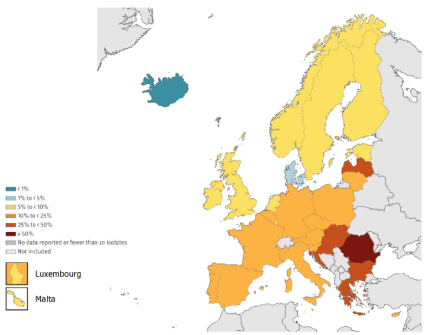



Figure 8. *Staphylococcus aureus*. Percentage of invasive isolates resistant to meticillin (MRSA), by country, EU/EEA, 2019

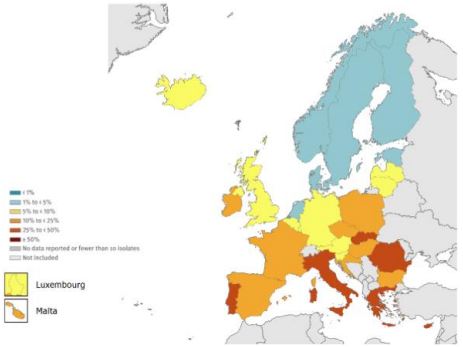



Figure 10. *Enterococcus faecium*. Percentage of invasive isolates resistant to vancomycin, by country, EU/EEA, 2019

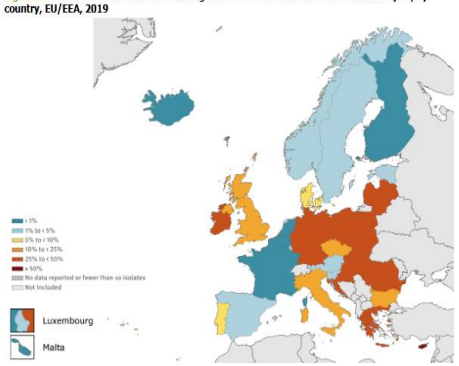



Figure 7. *Acinetobacter* species. Percentage of invasive isolates with resistance to carbapenems (imipenem or/and meropenem), by country, EU/EEA, 2019

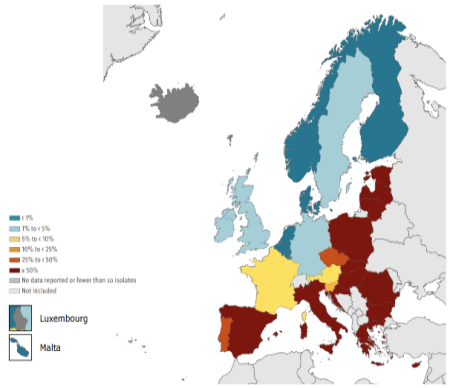



Figure 1. *Escherichia coli*. Percentage of invasive isolates resistant to fluoroquinolones (ciprofloxacin or/and levofloxacin or/and ofloxacin), by country, EU/EEA, 2019

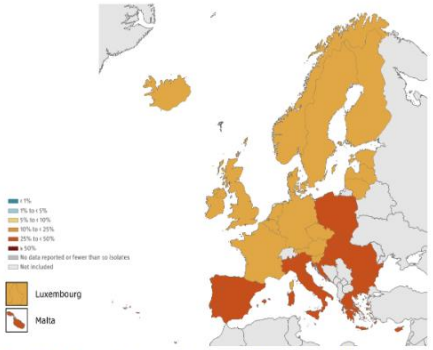
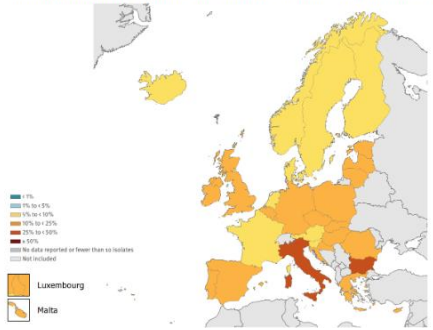



Figure 2. *Escherichia coli*. Percentage of invasive isolates resistant to third-generation cephalosporins (cefotaxime or/and ceftriaxone or/and ceftazidime), by country, EU/EEA, 2019




https://www.ecdc.europa.eu/en/publications-data/downloadable-tables-antimicrobial-consumption-annual-epidemiological-report-2019

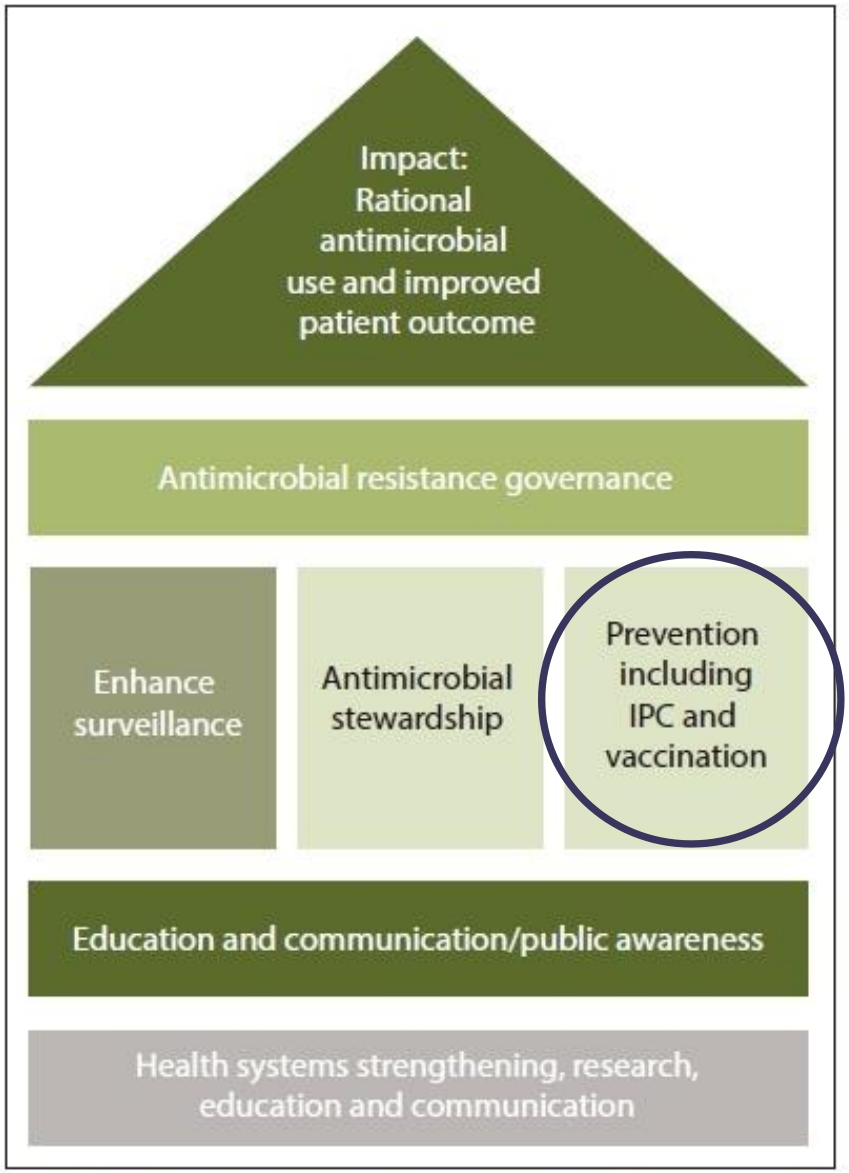
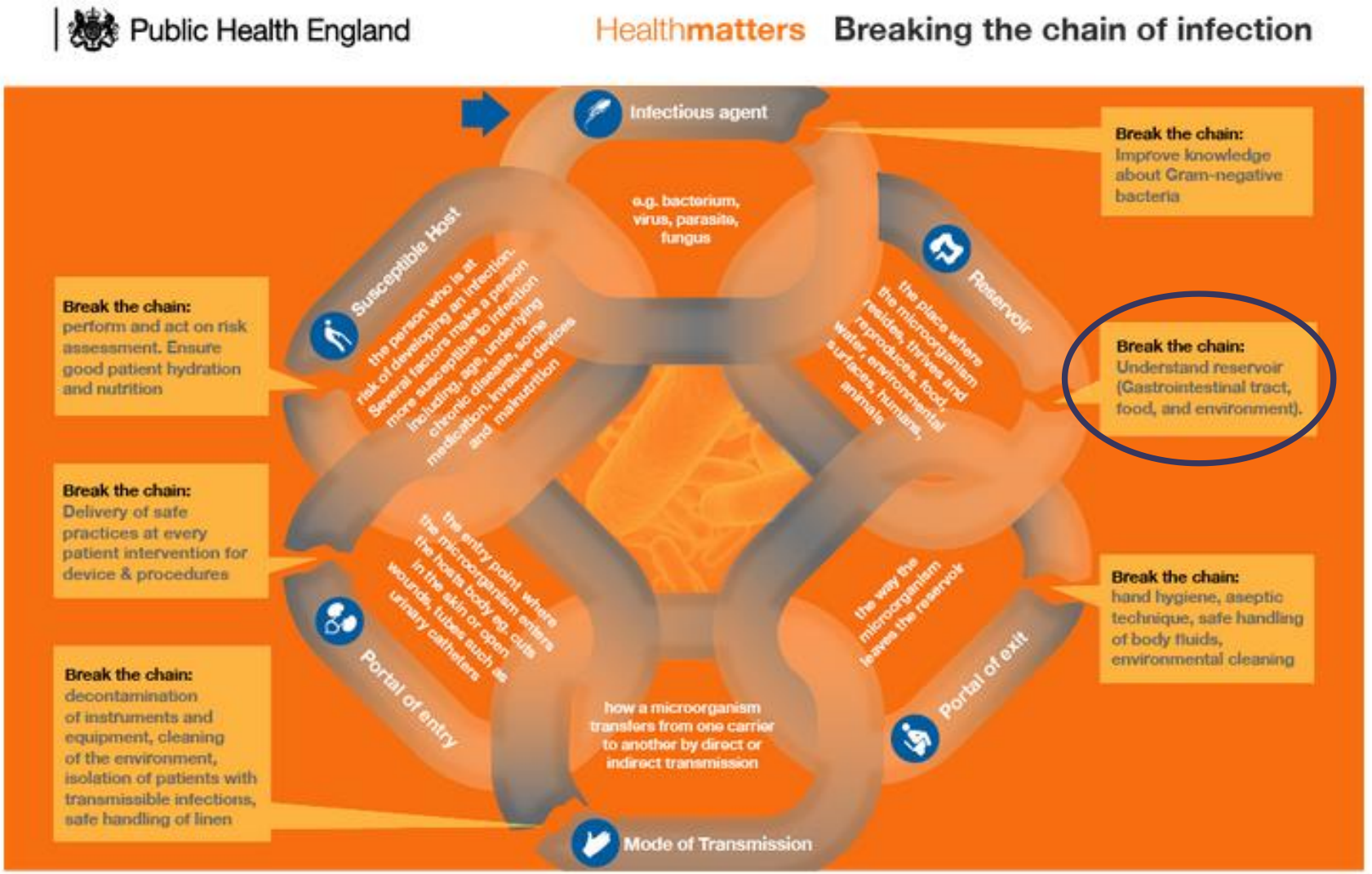



*Fig. 1. Pillars of the South African antimicrobial stewardship strategy framework.[6] (IPC = infection prevention and control.)*

http://dx.doi.org/10.7196/samj.2018.v108i7.13149

# Preventing infections



# Aim

- Evaluate the impact of environmental cleanliness through the Probiotic Cleaning Hygiene System (PCHS) on the incidence of healthcare-associated infections (HAIs) in acute care settings
- Probiotic Cleaning Hygiene System (PCHS)
  - Ecosustainable detergen conteings spores of *Bacillus spp.* – non pathogens

# Data are available

RESEARCH ARTICLE

## Reducing healthcare-associated infections incidence by a probiotic-based sanitation system: A multicentre, prospective, intervention study

**Elisabetta Caselli[1,2]*, Silvio Brusaferro[3], Maddalena Coccagna[2], Luca Arnoldo[3], Filippo Berloco[4], Paola Antonioli[5], Rosanna Tarricone[6], Gabriele Pelissero[7], Silvano Nola[8], Vincenza La Fauci[9], Alessandro Conte[3], Lorenzo Tognon[10], Giovanni Villone[11], Nelso Trua[12], Sante Mazzacane[2], for the SAN-ICA Study Group[1,2,3,4,5,6,7,8,9,10,11,12¶]**

PLoS One. 2018 Jul 12;13(7):e0199616

*pathogens*

MDPI

*Article*

## A Probiotic-Based Sanitation System for the Reduction of Healthcare Associated Infections and Antimicrobial Resistances: A Budget Impact Analysis

Rosanna Tarricone [1,2], Carla Rognoni [1,*], Luca Arnoldo [3], Sante Mazzacane [4] and Elisabetta Caselli [4,5]

Pathogens 2020 Jun 23;9(6):502

Infection and Drug Resistance

Dovepress

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ORIGINAL RESEARCH

## Impact of a probiotic-based hospital sanitation on antimicrobial resistance and HAI-associated antimicrobial consumption and costs: a multicenter study

Infect Drug Resist. 2019 Feb 27;12:501-510

# Methods

- Pre-post interventional study
- 5 acute hospitals were included:
  - general medicine, geriatrics and neurological wards;
  - from different part of Italy: 3 in the north, 1 in centre and 1 in south
- Timetable:
  - 6 months of pre-interventional survey:
    - January-June 2016 for three hospitals: $I_1$
    - May-October 2016 for the other two: $I_2$
  - Pause period for the PCHS system start-up:
    - 6 months for $I_1$
    - 2 months for $I_2$
  - 6 months of survey during PCHS application: January-June 2017 for all the five hospitals
- 1 control hospital especially included for the evaluation of the environmental impact

# Patients characteristics

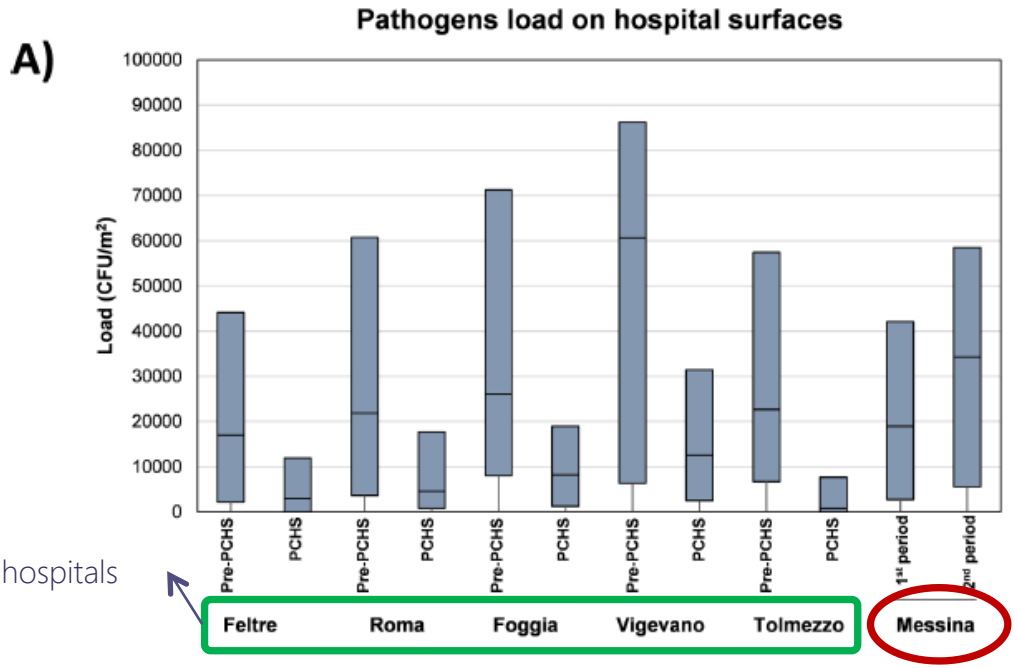
Table 2. Patient characteristics of the $I_1$-$I_2$ hospitals in the pre-PCHS and PCHS periods (11,461 patients).

| Patients characteristics | Pre-PCHS | PCHS |
|---|---|---|
| | Total patients No. (%) | Total patients No. (%) |
| Total | 5,930 | 5,531 |
| Gender: male | 2,977 (50.2%) | 2,928 (52.9%) |
| Age <65 | 1,518 (25.6%) | 1,265 (22.9%) |
| Age 65–74 | 1,261 (21.3%) | 1,177 (21.3%) |
| Age 75–84 | 1,821 (30.7%) | 1,753 (31.7%) |
| Age ≥85 | 1,330 (22.4%) | 1,336 (24.2%) |
| Incontinence | 1,448 (24.4%) | 1,369 (24.8%) |
| Disorientation | 804 (13.6%) | 747 (13.5%) |
| Self-sufficiency | 3,671 (61.9%) | 3,632 (65.7%) |
| Pressure sores | 393 (6.6%) | 237 (4.3%) |
| Surgery 30 day before | 122 (2.1%) | 80 (1.4%) |
| Ventilation | 215 (3.6%) | 161 (2.9%) |
| Parenteral nutrition | 200 (3.4%) | 141 (2.5%) |
| ATB 2 week before | 566 (9.5%) | 294 (5.3%) |
| MDRO at admission | 131 (2.2%) | 83 (1.5%) |
| Infection at admission | 1,216 (20.5%) | 1,089 (19.7%) |
| Urinary catheter (any type) | 1,368 (23.1%) | 1,166 (21.1%) |
| CVC | 264 (4.5%) | 260 (4.7%) |

Self-sufficiency, ability to provide for themselves autonomously, measured by SSM (Self Sufficiency Matrix) scale; ATB, antibiotics; MDRO, multi drug resistant organism; CVC, central vascular catheter.

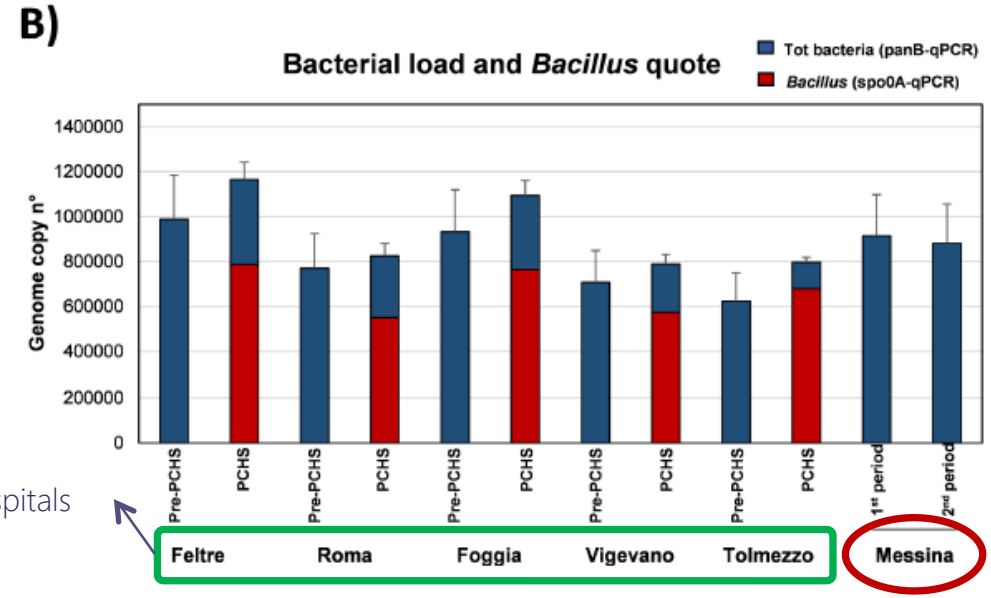
Evaluation of sample (sink, floor, bed footboard) for:

- *Staphylococcus spp.*
- *Enterobacteriaceae spp.*
- *Acinetobacter spp.*
- *Mycetes*
- *Pseudomonas spp.*
- *C. difficile*




Interventional hospitals

Control hospital




Interventional hospitals

Control hospital

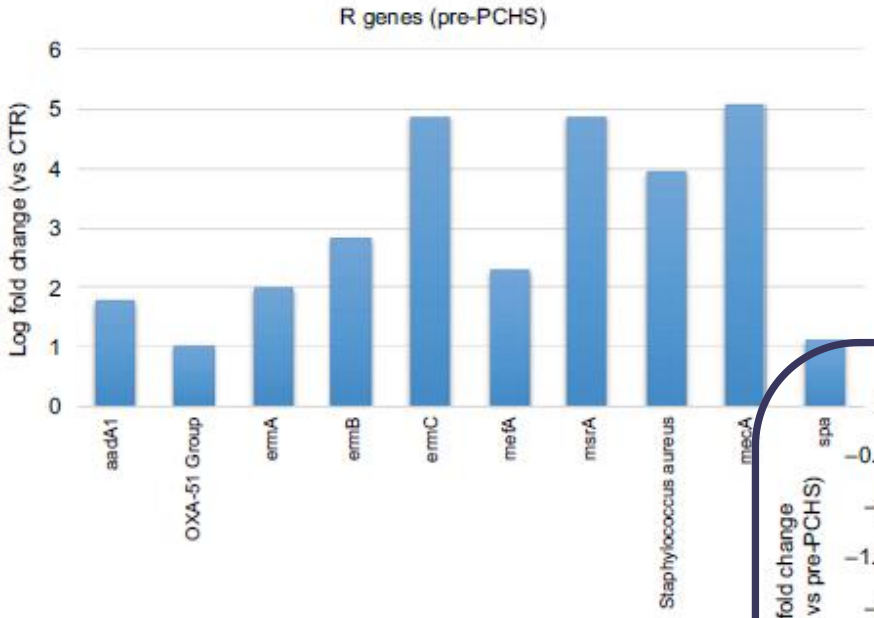
**Table 1** Variations in individual pathogens' load on hospital surfaces during pre-PCHS and PCHS (CFU/m$^2$)

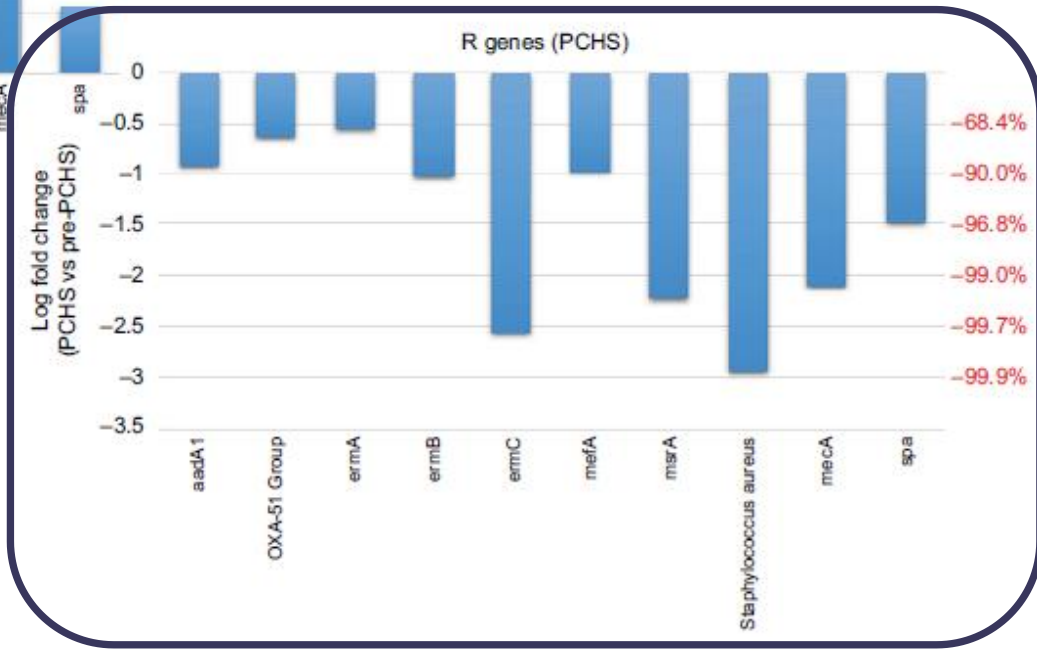
| Pathogen type | Pre-PCHS[a] | PCHS[a] | Decrease (%) |
|---|---|---|---|
| *Aspergillus* spp. | 181±307 | 12±6 | 93.3 |
| *Candida* spp. | 2,597±1,798 | 1,108±559 | 57.3 |
| *Clostridium difficile* | 334±290 | 132±219 | 60.5 |
| *Pseudomonas aeruginosa* | 970±982 | 415±350 | 57.2 |
| *Acinetobacter baumannii* | 2,844±841 | 520±726 | 81.7 |
| *Enterobacteriaceae* spp. | 1,774±901 | 189±135 | 89.3 |
| *Staphylococcus* spp. | 26,947±17,293 | 4,674±3,799 | 82.7 |

**Note:** [a]Results are expressed as mean value of CFU/m$^2$ ± SD detected in the five enrolled hospitals.

**Abbreviations:** PCHS, Probiotic Cleaning Hygiene System; CFU, colony forming units.

# Bacterial resistome



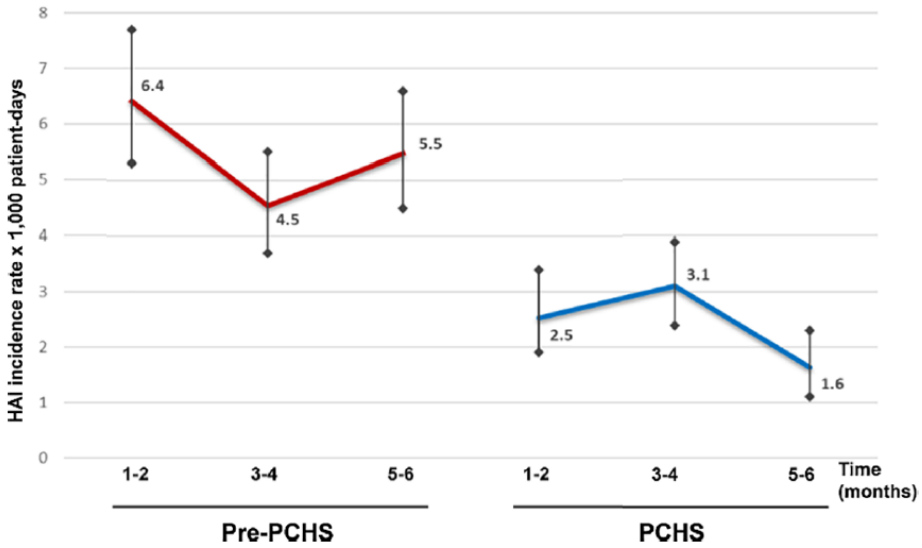
# Comparison of HAI incidence between phases:

- pre-PCHS (Conventional Chemical Cleaning)

&

- PCHS

| | All the population N. 11,461 | | | Propensity score matching sample N. 8,320 | | |
|---|---|---|---|---|---|---|
| | Pre-PCHS | PCHS | | Pre-PCHS | PCHS | |
| Cumulative incidence of patients with at least on HAI | 4.8% (284/5,930) | 2.3% (128/5,531) | OR 0.47 CI 95% 0.38-0.58 | 4.6% (191/4,160) | 2.4% (100/4,160) | OR 0.47 CI 95% 0.37-0.60 |
| Incidence rate x 1,000 hospitalisation days | 5.4 (314/57,742) | 2.4 (141/58,201) | OR 0.45 CI 95% 0.36-0.54 | 5.2 (210/40,111) | 2.5 (111/44,751) | OR 0.47 CI 95% 0.38-0.60 |



# Impact of risk factors on HAI onset

Table 5. Risk factors associated with HAI onset in patients of $I_1$-$I_2$ hospitals: Multivariable model*.

| Population characteristics | *P* | OR | 95% CI |
|---|---|---|---|
| Male | 0.01812 | 0.78 | 0.63–0.96 |
| Age 65–74 *vs* Age <65 | 0.0047 | 1.71 | 1.18–2.48 |
| Age 75–84 *vs* Age <65 | 0.0004 | 1.88 | 1.33–2.67 |
| Age 85 or more *vs* Age <65 | 0.0026 | 1.78 | 1.22–2.58 |
| Length of stay | p<0.0001 | 1.08 | 1.07–1.09 |
| Incontinence | 0.2253 | 0.85 | 0.66–1.10 |
| Disorientation | 0.0226 | 1.37 | 1.05–1.76 |
| Self-sufficiency | 0.5600 | 0.92 | 0.69–1.43 |
| Pressure sores | 0.9757 | 0.99 | 0.69–1.44 |
| Ventilation | 0.7702 | 1.07 | 0.68–1.67 |
| ATB 2 week before | 0.8479 | 0.97 | 0.68–1.37 |
| MDRO at admission | 0.6230 | 0.86 | 0.47–1.57 |
| Urinary catheter (any type) | p<0.0001 | 2.68 | 2.10–3.41 |
| CVC | 0.0001 | 1.99 | 1.40–2.82 |
| PCHS | p<0.0001 | 0.44 | 0.35–0.54 |

# Conclusions

- Data suggests a positive effect of PCHS application in order to prevent the HAIs onset in the involved wards
- PCHS effect seems to be higher for the HAIs transmitted by contact
- Important to sustain the further researches:
  - other time period
  - different care settings

# THE ELECTRIC LIGHT DID NOT COME FROM THE CONTINUOUS IMPROVEMENT OF CANDLES

(OREN HARARI)