



Towards higher patient safety in EU hospitals

Innovation in hygiene & sanification to reduce healthcare associated infections and antimicrobial resistance.

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European Parliament



**The role of innovation in hygiene & sanification:
*a multicentre, prospective, intervention study***

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BACKGROUND



Healthcare associated infection (HAI) are a global concern (5-15% patients): over **4 millions patients** with HAI in EU every year. About **37000 deaths** as a direct HAI consequence.



Major causes:

- **Persistent microbial contamination** on hospital surface
- **Antimicrobial resistance (AMR)**: most if not all HAI-associated pathogens are MDR or even panDR



So far, control of contamination addressed by conventional **chemical-based sanitation**:

- cannot prevent **recontamination**
- high environmental impact
- can favour **selection of resistance** (i.e. chlorexidin induction of ColR in KPC)



New effective methods:

- **STABLY** abate contamination
- **Devoid of «side effects»** (AMR)

PCHS

Probiotic Cleaning Hygiene System



PCHS: results

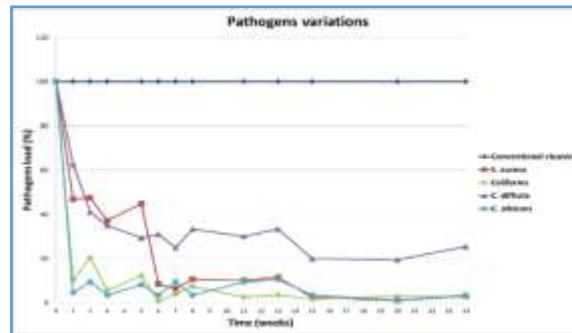
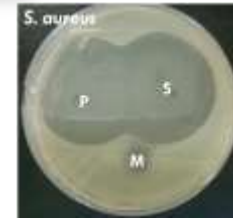
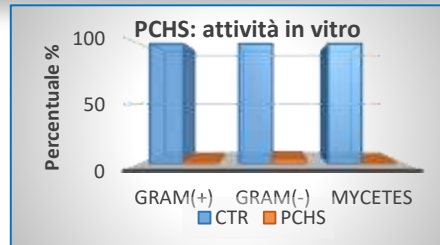
1. STABLE ABATEMENT of pathogens on surfaces (*in vitro* and on field)

Up to **-90%** compared to conventional sanitation

2. NO AMR selection

Up to **100 folds**

3. SAFETY of use



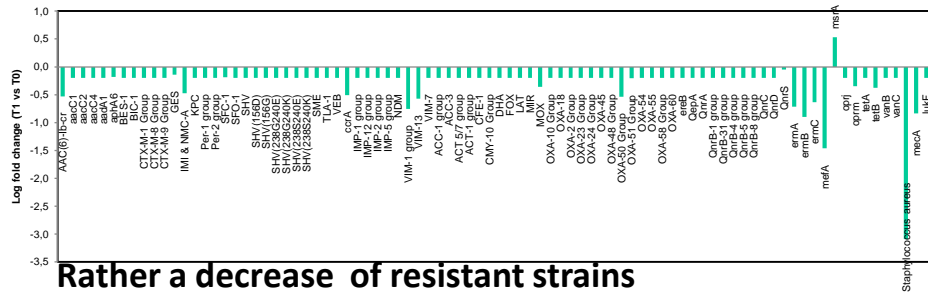
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PLOS ONE

Hard Surface Biocontrol in Hospitals Using Microbial-Based Cleaning Products

Alberta Vanzini¹, Robin Temmerman^{2,3}, Alessia Frabetti⁴, Elisabetta Caselli⁵, Paola Antonelli⁶, Pier Giorgio Balbani⁷, Daniela Pisanò⁸, Alessio Branchini⁹, Sante Mazzacane¹⁰

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Rather a decrease of resistant strains

PLOS ONE

Impact of a Probiotic-Based Cleaning Intervention on the Microbiome Ecosystem of the Hospital Surfaces: Focus on the Resistant Biomodulation

Alberta Vanzini¹, Robin Temmerman^{2,3}, Alessia Frabetti⁴, Elisabetta Caselli⁵, Paola Antonelli⁶, Pier Giorgio Balbani⁷, Daniela Pisanò⁸, Alessio Branchini⁹, Sante Mazzacane¹⁰

Genetic stability: no genetic modifications in 8 years (molecular analysis)

No infectious risk: no infections in hospitalized patients in 8 years analysis; no *Bacillus* presence in biological samples from patients

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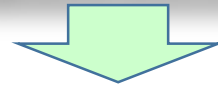
Letters to the Editor

Safety of probiotics used for hospital environmental sanitation

Only a quota of samples was also specific real-time quantitative PCR analysis described. The study was funded by the Italian Ministry of Health.

E. Caselli¹, P. Antonelli¹, S. Mazzacane¹

Can PCHS-induced remodulation of hospital environment microbiota impact on HAI incidence?



Multi-center SAN-ICA study

Pre-post interventional study

18 months

6 Hospitals & 5 Universities in Italy

The Inanimate Environment Can Facilitate Transmission



Infection Prevention and Control

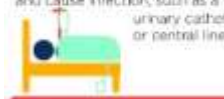
Susceptible host

A person who is potentially vulnerable to an infection



Portal of entry

Site through which a pathogen can enter the susceptible host and cause infection, such as a urinary catheter or central line



Infectious agents

Pathogenic (disease-causing) microbes such as bacteria, parasites, viruses, or fungi



Reservoirs

Hosts or habitats - such as humans, animals, or environment - where infectious agents live and reproduce



Understanding the chain of infection

RESERVOIR?

>32,000
environmental
samples



Simultaneous analysis of
1. Surface bioburden
2. HAI incidence



>12,000
patients

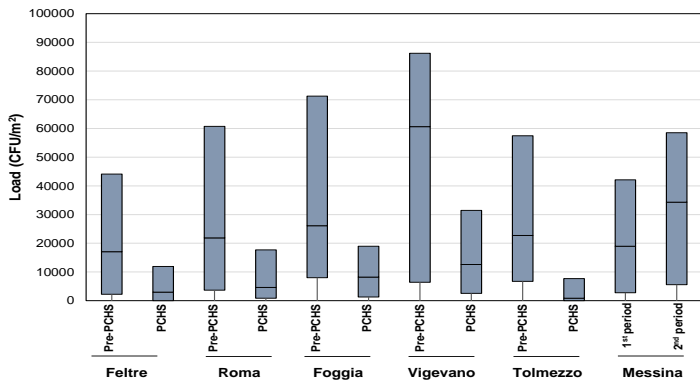
SAN-ICA RESULTS

1. STABLE MICROBIOME REMODULATION

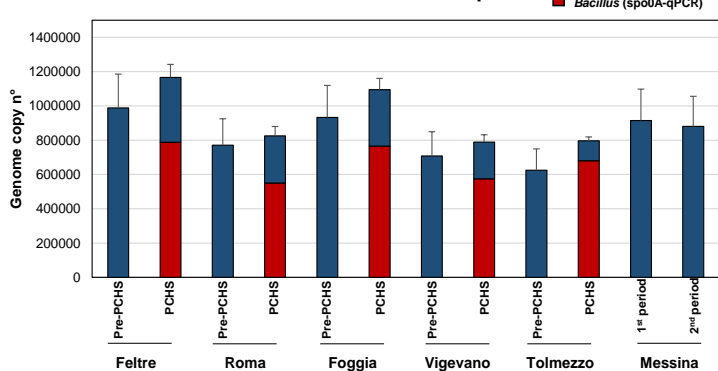
Mean reduction = **-83,0%**

Pathogens replaced by PCHS-*Bacilli* (70%)

Pathogens load on hospital surfaces



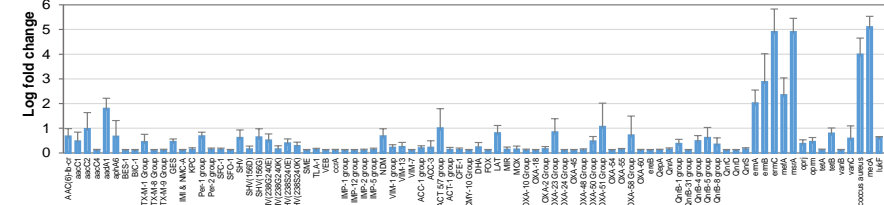
Bacterial load and *Bacillus* quote



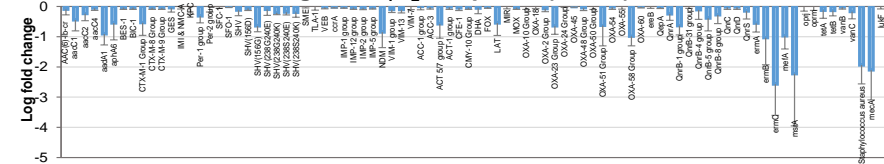
2. STABLE AMR DROP

Up to **-99%** (by molecular assays & antibiograms)
No reduction in the non-treated hospital

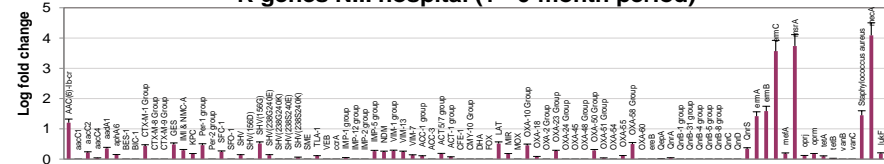
R genes I₁-I₂ hospitals (Pre-PCHS)



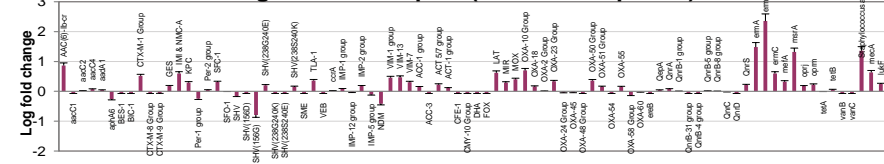
R genes I₁-I₂ hospitals (PCHS)



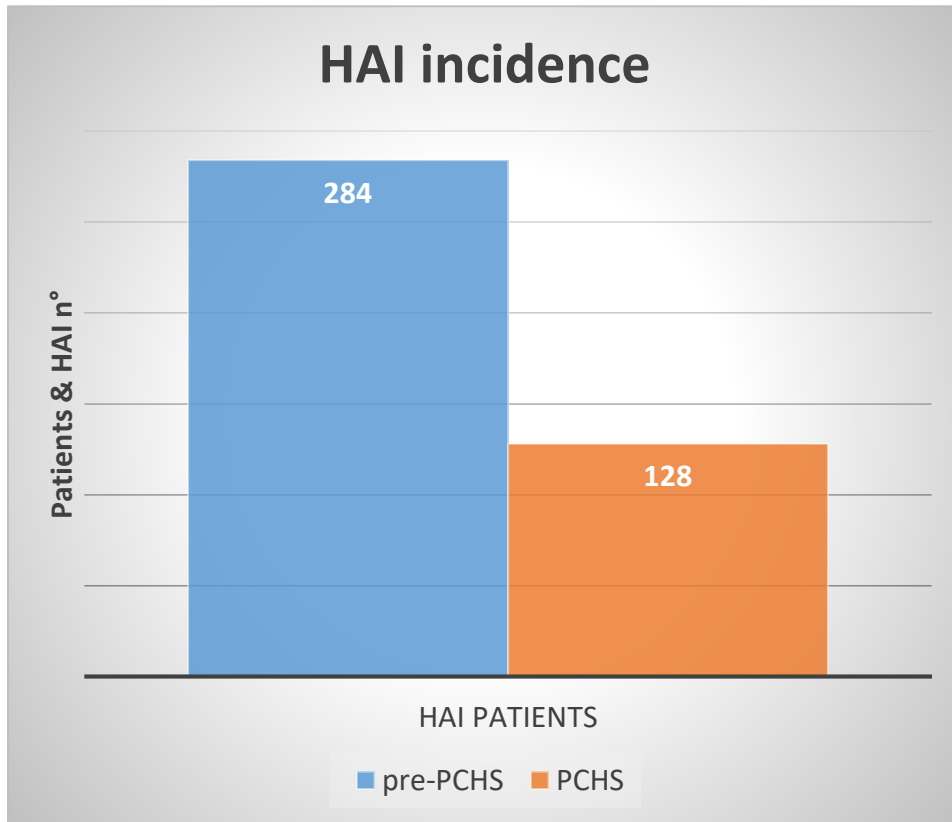
R genes N.I. hospital (1st 6-month period)



R genes N.I. hospital (2nd 6-month period)



3. HAI REDUCTION



-52%

HAI incidence reduction



-60%

HAI-associated antimicrobial drug consumption



-75%

HAI-associated antimicrobial therapy costs

CONCLUSIONS



**Actions on
environmental
reservoir
(microbiome
remodulation) can
significantly impact
on AMR & HAIs**

(The system can be further improved
Work in progress on BACTERIOPHAGES
(the enemies of our enemies)*