

Towards higher patient safety in EU hospitals.
Innovation in hygiene & sanification to reduce healthcare associated infections and antimicrobial resistance.

RESEARCH ARTICLE

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

Elisabetta Caselli^{1,2*}, Silvio Brusaferrò³, Maddalena Coccagna², Luca Arnoldo³, Filippo Berloco⁴, Paola Antonioli⁵, Rosanna Tarricone⁶, Gabriele Pelissero⁷, Silvano Nola⁸, Vincenza La Fauci⁹, Alessandro Conte³, Lorenzo Tognon¹⁰, Giovanni Villone¹¹, Nelso Trua¹², Sante Mazzacane², for the SAN-ICA Study Group^{1,2,3,4,5,6,7,8,9,10,11,12}



Luca Arnoldo
on behalf of SANICA study group



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;
 - Pause period for the PCHS system start-up;
 - 6 months of survey during PCHS application;
- cleaning staff did not change during the study and were adequately trained for the appropriate PCHS application;
- ward healthcare personnel and patients were not aware about the change of the cleaning system;
- not introduced any new intervention potentially affecting HAIs incidence throughout the whole study

Main Results

11,416 patients:

- 5,930 pre-intervention phase (pre-PCHS)
- 5,531 PCHS-phase

		Patients (n.)			Age (mean±DS)		Hospitalisation stay (mean±DS)	
Group	Healthcare Structure	Total	Pre-PCHS	PCHS	Pre-PCHS	PCHS	Pre-PCHS	PCHS
I ₁	Hospital 1	2,812	1,599	1,213	73.1±16.4	74.9±15.4	8.7±5.7	10.0±6.1
I ₁	Hospital 2	1,951	966	985	72.4±15.9	74.7±14.8	9.9±5.4	12.0±7.1
I ₁	Hospital 3	3,116	1,611	1,505	68.0±17.8	68.1±17.2	10.4±8.9	11.0±7.3
I ₂	Hospital 4	2,453	1,186	1,267	74.3±14.3	75.9±13.3	10.6±9.8	9.8±6.3
I ₂	Hospital 5	1,129	568	561	72.7±15.5	72.6±16.1	8.9±5.4	9.6±6.2
Tot. (I₁+I₂)		11,461	5,930	5,531	71.8±16.4	73.0±15.8	9.7±7.6	10.5±6.7

Main results

Risk factors

Patients characteristics	Pre-PCHS	PCHS
	Patients N. (%)	Patients N. (%)
Overall	5,930	5,531
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%)
Presence of pressure sores*	393 (6.6%)	237 (4.3%)
Surgery 30 days before*	122 (2.1%)	80 (1.4%)
Ventilation*	215 (3.6%)	161 (2.9%)
Parental nutrition*	200 (3.4%)	141 (2.5%)
ATB 2 weeks 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%)
Presence of urinary catheter*	1,368 (23.1%)	1,166 (21.1%)
Presence of CVC	264 (4.5%)	260 (4.7%)

*p<0.05

Main Results

HAls incidence

Cumulative incidence of patients with at least on HAI:

■ Pre-PCHS = **4.8%** (284/5,930)

■ PCHS = **2.3%** (128/5,531)

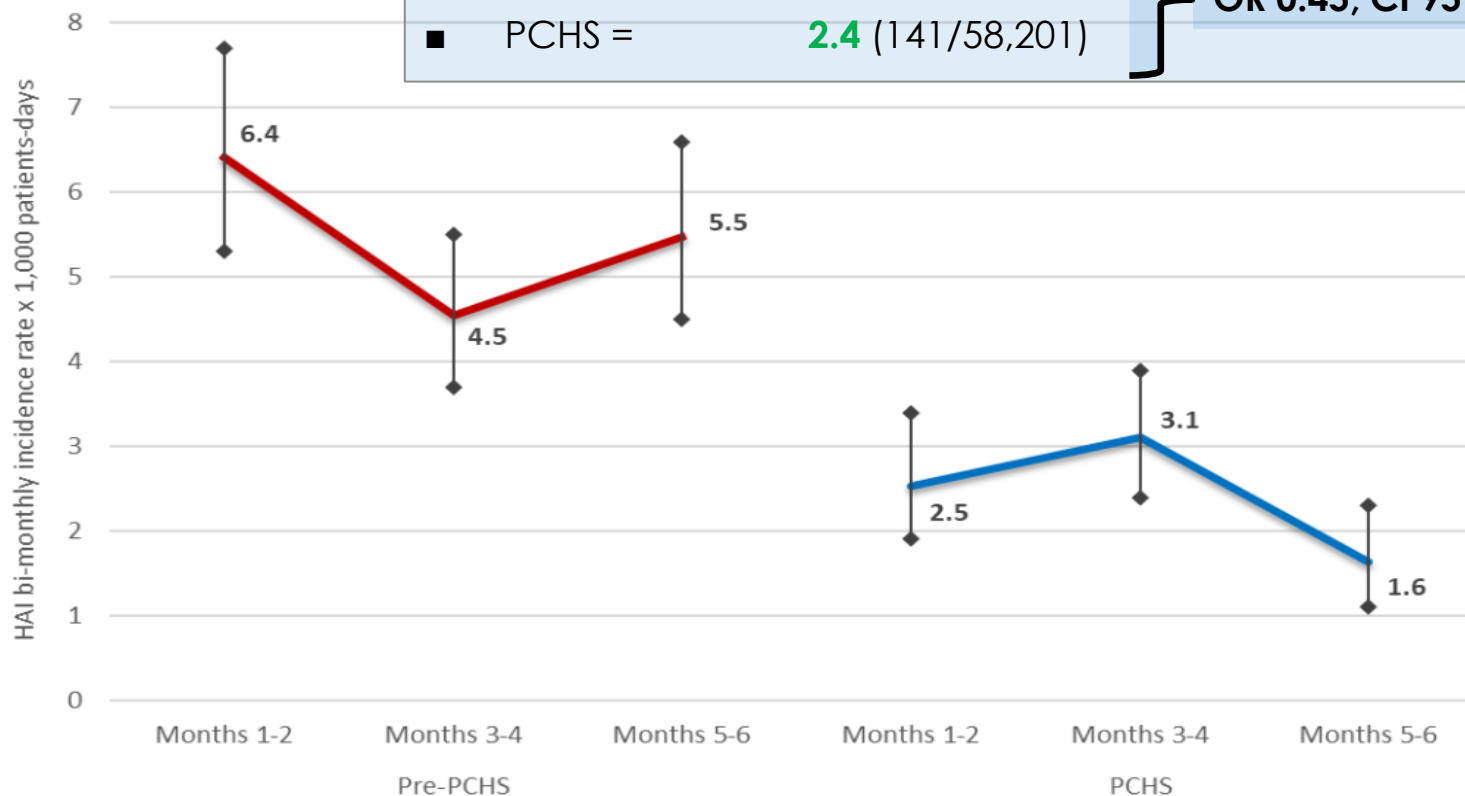
OR 0.47, CI 95% 0.38-0.58

Incidence rate x 1,000 hospitalisation days:

■ Pre-PCHS = **5.4** (314/51,742)

■ PCHS = **2.4** (141/58,201)

OR 0.45, CI 95% 0.36-0.54



Main Results

Cumulative incidence stratified by HAI typology

Type of HAI	Phase				Chi-square test		
	pre-PCHS (n. 5,930)		PCHS (n. 5,531)		p	OR	CI 95%
	n.	%	n.	%			
Urinary tract infections	179	3.0%	70	1.3%	<0.01	0.41	0.31-0.54
Laboratory-confirmed bloodstream	54	0.9%	37	0.7%	0.15	0.73	0.48-1.12
Clinical sepsis	22	0.4%	5	0.1%	<0.01	0.24	0.09-0.64
Gastro-intestinal infections	17	0.3%	6	0.1%	<0.05	0.38	0.15-0.96
Skin and soft tissue infections	15	0.3%	6	0.1%	0.07	0.43	0.17-1.10
Pneumoniae	12	0.2%	8	0.1%	0.46	0.71	0.29-1.75
Others infections	15	0.3%	15	0.3%	0.85	1.07	0.52-2.20

Main Results

Logistic regression

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
Hospitalisation lenght	p<0.0001	1.08	1.07-1.09
Incontinence	0.2253	0.85	0.66-1.10
Disorientamento	0.0226	1.37	1.05-1.76
Self-sufficiency	0.5600	0.92	0.69-1.43
Presence of pressure sores	0.9757	0.99	0.69-1.44
Ventilation	0.7702	1.07	0.68-1.67
ATB 2 weeks before	0.8479	0.97	0.68-1.37
MDRO at admission	0.6230	0.86	0.47-1.57
Presence of urinary catheter*	p<0.0001	2.68	2.10-3.41
Presence of CVC	0.0001	1.99	1.40-2.82
Admission during PCHS phase	p<0.0001	0.44	0.35-0.54

Conclusions

- Data suggests a positive effect of PCHS application
 - to prevent the HAIs onset in the involved wards
- Further studies are needed to evaluate the impact of this technology, in particular to analyse:
 - other time periods;
 - different care settings;
- These data open a window on:
 - the microbiota use for cleaning processes and its role in HAIs prevention and control;
 - the impact evaluation of environmental bio-burden for HAIs onset and tools for measure it

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

(O. HARARI)

luca.arnoldo@uniud.it



**UNIVERSITÀ
DEGLI STUDI
DI UDINE**