PROBIOTIC CLEANING TECHNOLOGY FOR HEALTHCARE FACILITIES

Chrisal

Est. 1989, Belgium

Cleaning, hygiene and personal care products

PIP – 2006
Probiotics in Progress line is released

Pure, with respect to man and nature

Presentation overview:

Probiotics in Progress "PIP"

- **What is a probiotic cleaner?**
- **Where and why are they used?**
- **How do they work?** mechanisms of action
- **Efficacy - historical & present day research**
- **Discussion/Questions –Implementation & Use**
- **Resources – Email List**
- **Follow up: Individual Facility Discussions**

Chrisal
CLEANING PRODUCTS

PIP probiotic cleaning products uses

Probiotic Detergents

Probiotic Concentrates

- Healthcare Facilities
- Elder Care -Long term
- Childcare/ Daycare
- Schools Homes
- Offices Airports
- Transit -buses
- Recreation centers
- Fitness Facilities
- Bars Sports Stadiums
- Apartments
- Swimming Pools
- Flood Clean up
- Lonely Death company

Chrisal
CLEANING PRODUCTS

What is Probiotic Cleaning?

Probiotic cleaning products are detergents.

They are NOT biocides/disinfectants!

DO NOT NEED or QUALIFY for DIN numbers.

European Commission. July 2016:

*Following discussions with DG GROW and industry, it has been established that the **Detergents Regulation** should be interpreted to mean that **microbial cleaning products** that have the combined action of traditional surfactants and bacteria **fulfil the definition of a detergent** as set out in the Detergents Regulation and fall, therefore, under its scope.*

Chrisal
CLEANING PRODUCTS

Probiotic cleaning action

Product ingredients function

1. **Detergents** (chemical)
   - Immediate removal of superficial dirt
   - Immediate action - up to 30 min activity
2. **Enzymes** (biochemical)
   - Removal of organic dirt
   - Active after 10 min -up to 2 hrs activity
3. **Probiotics** (biological)
   - Removal of organic dirt and biofilm
   - Active after 20 min -up to 3 days active

Combination provides ongoing hygiene & pathogen control

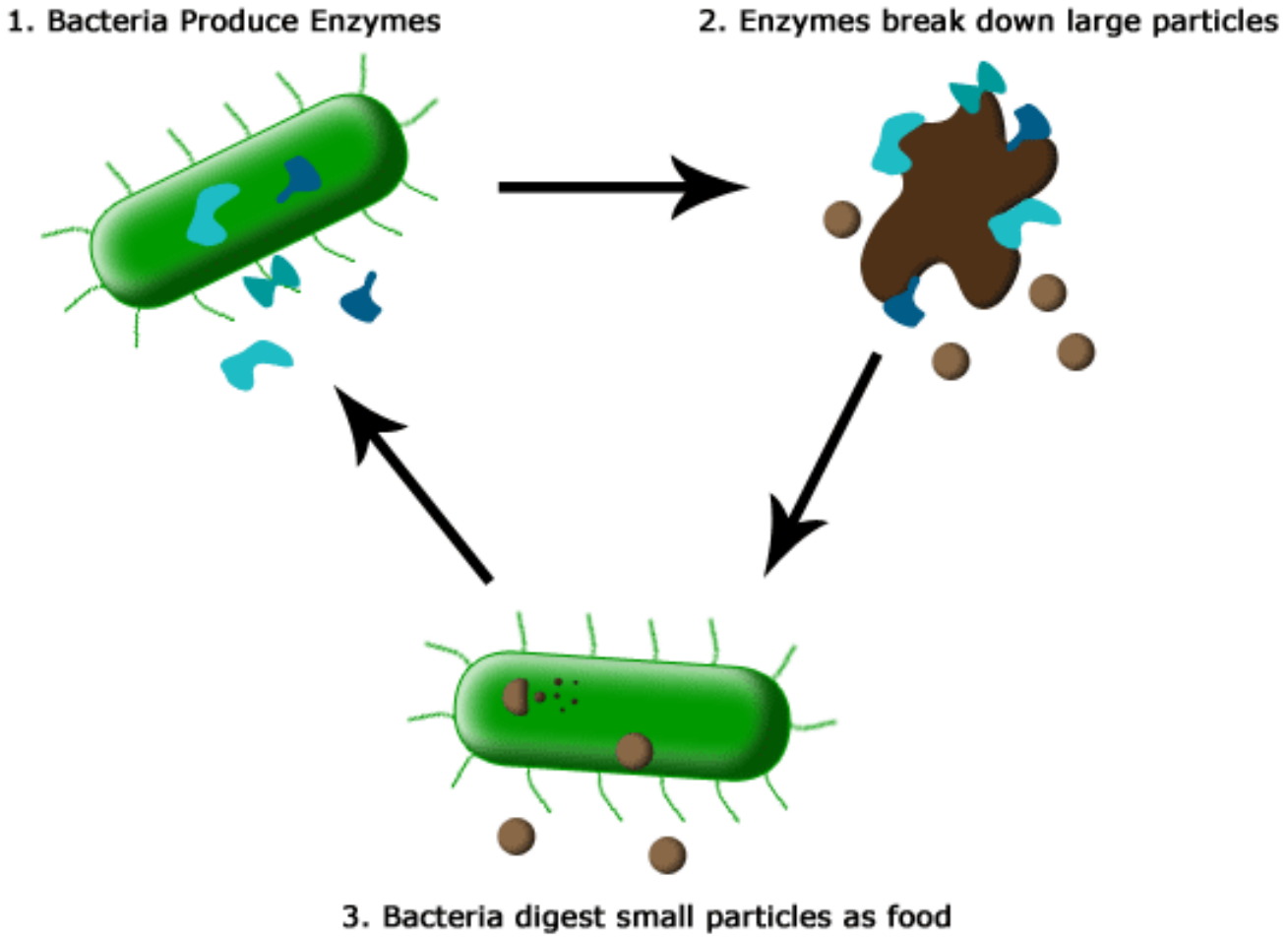
Chrisal
CLEANING PRODUCTS

Probiotic Cleaning Mechanisms of Action:

1. Competitive Exclusion
2. Biofilm Removal
3. Quorum Sensing

Chrisal
CLEANING PRODUCTS

PROBIOTIC ACTION



Chrisal
CLEANING PRODUCTS

PROBIOTIC ACTION #1

COMPETITIVE EXCLUSION

From the moment they become active, the probiotics produce a broad range of substrate specific enzymes

that break down organic matter (& BIOFILMS, DUST MITE WASTES)

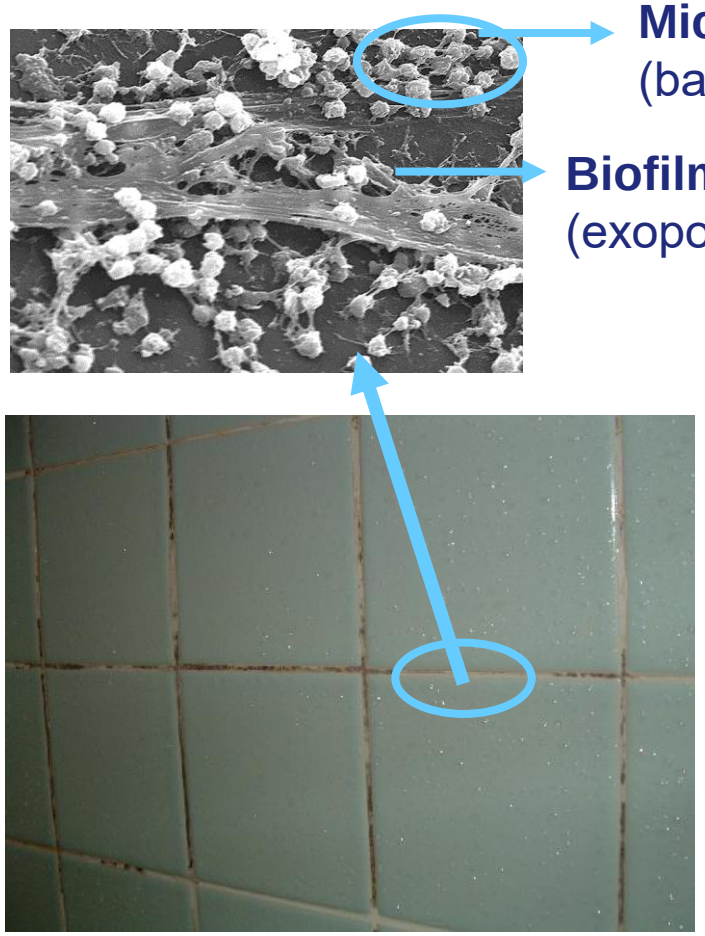
which the probiotic bacteria to use as a food source.

By consuming organic matter, there is less food for other microorganisms = lowered risk of pathogens on surfaces

Surfaces are being continuously cleaned in a biological way!

Chrisal
CLEANING PRODUCTS

PROBIOTIC ACTION #2
PROBIOTIC BACTERIA
USE BIOFILMS AS FOOD SOURCE



Micro-organisms
(bacteria, fungi, archeae, algeae…)

Biofilm binding matrix made of organic structures
(exopolysaccharides, proteines…)

Universal presence on surfaces

Very tenacios - dificult to remove

Pathogen reservoir

Source of bad smells/ odours

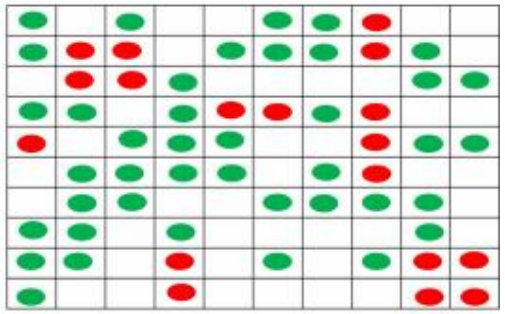
Disinfectants cannot penetrate

Develops chemical resistance

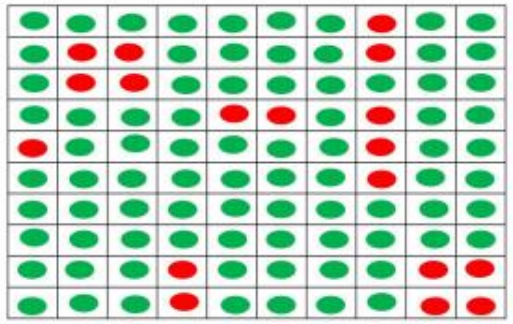
Resistance adds to AMR

Chrisal
CLEANING PRODUCTS

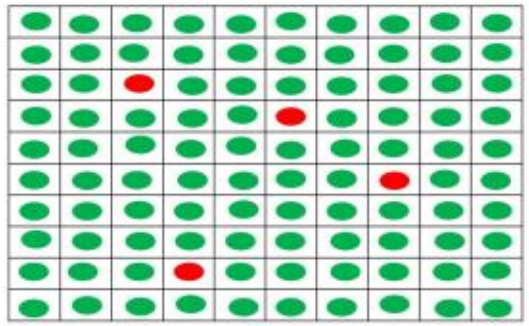
REPRESENTATION OF PROBIOTIC ACTION



Representation of normal microflora distribution on the average surface note open spaces important for future colonization



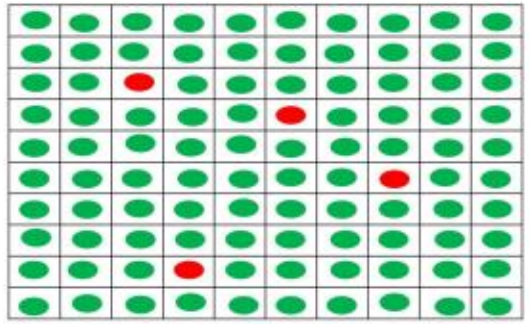
Application of PIP makes the probiotic bacteria dominant filling up the spaces



When all spaces are filled, and food becomes scarce, the bacteria release quorum signals ‘saying’ there is no food or space left!

Chrisal
CLEANING PRODUCTS

QUORUM SENSING



When quorum sensing signals are released, all bacteria cease activity / reproduction. This eliminates more remaining pathogen colonies.

This naturally occurring QS mechanism happens at approximately the 72 hour mark after PIP application (germination).

Routine cleaning will continually repopulate surfaces with probiotic bacteria, leaving no space for pathogens to colonize into.

Example: fogging /cleaning every three days can maintain high numbers of probiotic bacteria and minimize pathogen growth - even in a kindergarten room!

Chrisal
CLEANING PRODUCTS

Healthcare Challenges

- **Antibiotic Resistance**

drugs used in healthcare, agriculture, aquaculture…

Munita and Arias. Mechanisms of antibiotic resistance. Microbiology Spectrum, april 2016.

- **Chemical Resistance**

disinfectants (bleach, quats), hydrogen peroxide, metals,

Gnanadhas et al. Biocides—Resistance, cross-resistance mechanisms and assessment. Expert Opinion on Investigational Drugs. December 2012
-McDonnell and Russell. Antiseptics and Disinfectants: Activity, Action, and Resistance. CLINICAL MICROBIOLOGY REVIEWS 1999.

- **Biofilm Resistance**

disinfectants, drugs, antimicrobial surfaces, autoclave

Stewart and Costerton. Antibiotic resistance of bacteria in biofilms. Lancet 2001
Bridier et al. Resistance of bacterial biofilms to disinfectants: a review. Biofouling 2001.

Chrisal
CLEANING PRODUCTS

Healthcare Challenge

What we now know...

Biocide resistance can stimulate resistance to antibiotics

Antibiotics + Biocides (and biocidal metals)

=

Increased Antibiotic Resistance

Literature:

Pal et al. Co-occurrence of resistance genes to antibiotics, biocides and metals reveals novel insights into their co-selection potential. Genomics 2015.

Chrisal
CLEANING PRODUCTS

Addressing Resistance Issues

Remove substances that trigger resistance!

1. Decreased use of antibiotics

2. Decreased use of

- **Disinfectants: bleach, quats, hydrogen peroxide**
- **Sanitizers**
- **Antimicrobial products:bedding, clothes, water bottles**

3. Above combined with populating areas with high numbers of probiotic bacteria reduces resistance genes!

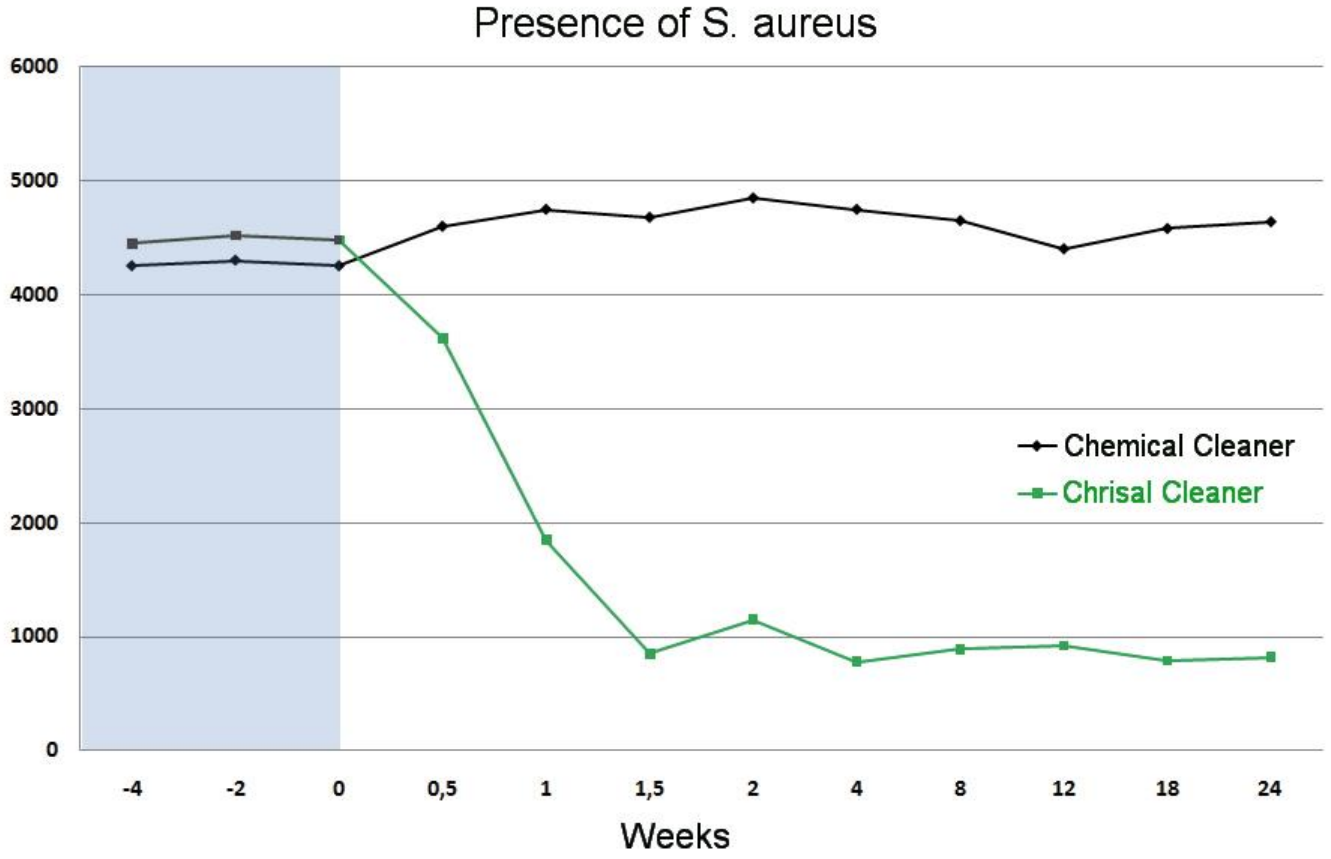
Chrisal
CLEANING PRODUCTS

Healthcare Challenge

Probiotic cleaners are proven to offer a safe, easy, sustainable and highly effective method to decrease these issues.

Chrisal
CLEANING PRODUCTS

Healthcare Challenge Efficacy



This study was conducted in operational hospitals with 20,000 samples.

Chrisal
CLEANING PRODUCTS

ADDITIONAL (HIDDEN) COST SAVINGS

- **Staff, patients, patrons, custodians health:**

Immune function preservation
Allergen Reduction in Facility
Respiratory Issue Reductions

- **Facility hygiene, appearance, perception**

Odours addressed at source – not covered up
Improved air quality – continuous pathogen ‘control’

- **Facility Infrastructure, Equipment**

No corrosion of metals, plastics, vinyls, floor finishes

- **Environment – air quality, waste water**

Cleaner drains, waste water ‘cleans’ as it leaves

Chrisal
CLEANING PRODUCTS

Microscopic deep cleaning

Chemical cleaning

Probiotic cleaning

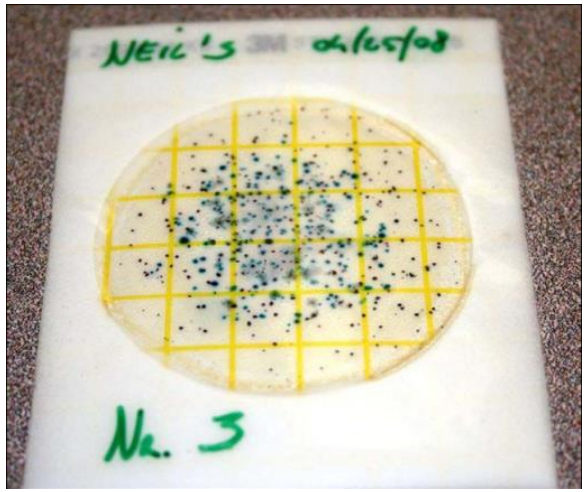
Chemical cleaning

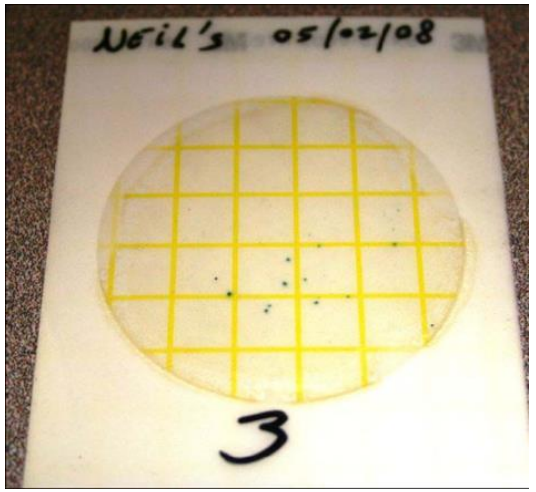
Probiotic cleaning

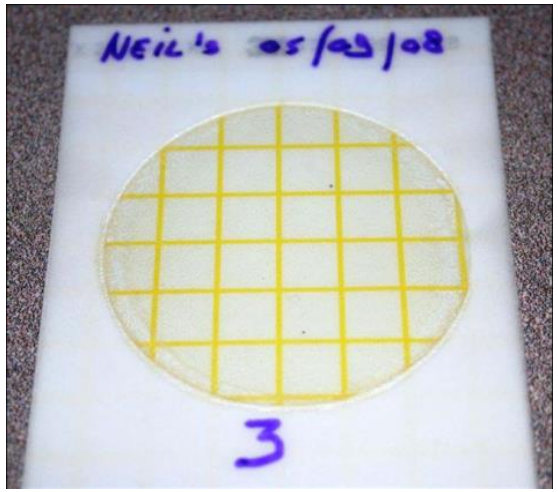
Chrisal CLEANING PRODUCTS

Good microflora replace pathogens

Staphylococcus aureus







Day 0 **Day 7** **Day 14**

Miami Home and Jewish Hospital Study, Florida, 2009

Chrisal
CLEANING PRODUCTS

Environmentally beneficial

vs

Environmentally friendly

Environmentally friendly (eco-friendly, nature-friendly, and green), are marketing terms for products that claim reduced, minimal, or no harm upon the environment.

Environmentally beneficial:

products that actively contribute to a cleaner healthier environment

Bacillus bacteria used for 1. Removing oil contaminations of palm oil from waste water, Removal/recovery of light and heavy crude oil. 2. Removing toxins from soil or water: Cyanide removal from (waste)water. 3. Removing harsh chemicals from soil or water: Treatment of tannery waste water, Removal of Fipronil from soil. 4. Removing heavy metals from soil or water: Removal of lead from wastewater, Removal of heavy metals from waste water. See Environment Beneficial resource for study information.

Why use Probiotic cleaning?

1. **Microscopic cleaning** sustainable and long lasting effect
2. **Active odour control** reduces labour / material costs
3. **Lowers pathogen risks** reduces HAI, cross contamination
4. **Reduces airborne pathogens / allergens** linen changes
5. **Continual biofilm removal** reduce labour-improve hygiene
6. **Reverse antibiotic resistance genes** improved outcome
7. **Non-toxic, Non-GMO** improved immune function (staff too)
8. **Non- caustic, Non-corrosive** no damage to infrastructure
9. **Environmentally beneficial – surfaces, air, soil, water**
10. **Cost saving – wide net of value added benefits**

Chrisal
CLEANING PRODUCTS

SANICA RESEARCH

Caselli et al. 2018

- **Duration:** 1st of January 2016 to 30th of June 2017
- **Hospitals involved in the study**: Roma, Foggia, Feltre, Tolmezzo, Vigevano, Messina.
- **Methodology:** 6 months of Conventional Cleaning and 6 months of PIP cleaning (Probiotics in Progress).

Reducing healthcare-associated infections incidence by a probiotic-based sanitation system: A multicentre, prospective, intervention study Caselli et al.https://doi.org/10.1371/ journal.pone.0199616 Published July 12, 2018

Chrisal
CLEANING PRODUCTS

SANICA RESEARCH PARTNERS

Universities that participated in the study:
Ferrara, Udine, Agostino Gemelli, Bocconi, Pavia, Messina and Foggia.

UNIVERSITÀ DEGLI STUDI DI UDINE

UNIVERSITY OF FERRARA
- EX LABORE FRUCTUS -

Gemelli

Fondazione Policlinico Universitario A. Gemelli
Università Cattolica del Sacro Cuore

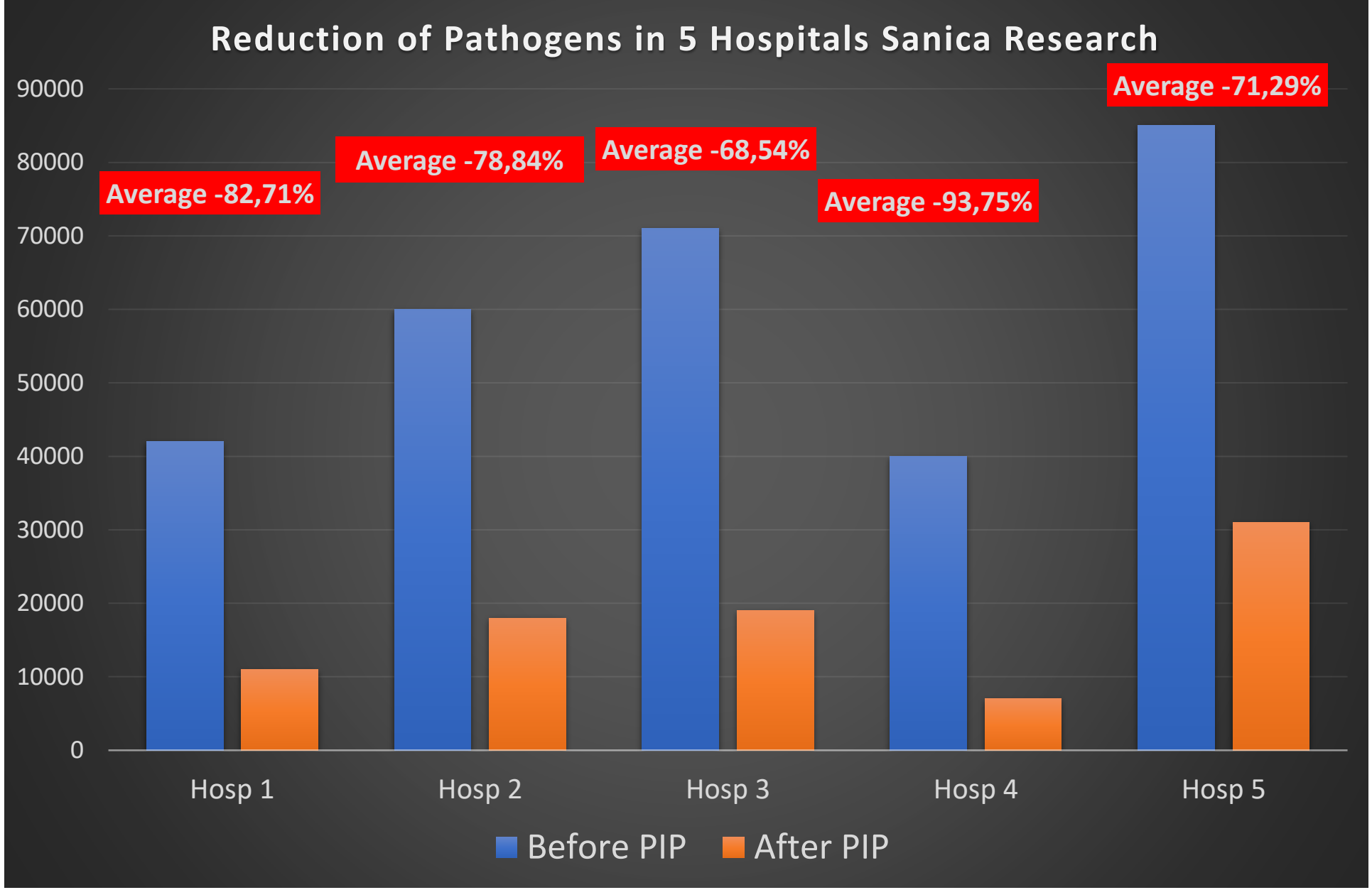
Università Bocconi
MILANO

UNIVERSITÀ DI PAVIA

UNIVERSITÀ DEGLI STUDI DI MESSINA

Università di Foggia

Chrisal
CLEANING PRODUCTS



Rodac plates of Staphylococcal spp., enterobacteriaceae spp; acinetobacter ssp., Candida spp; pseudomonas spp; clostridium spp).

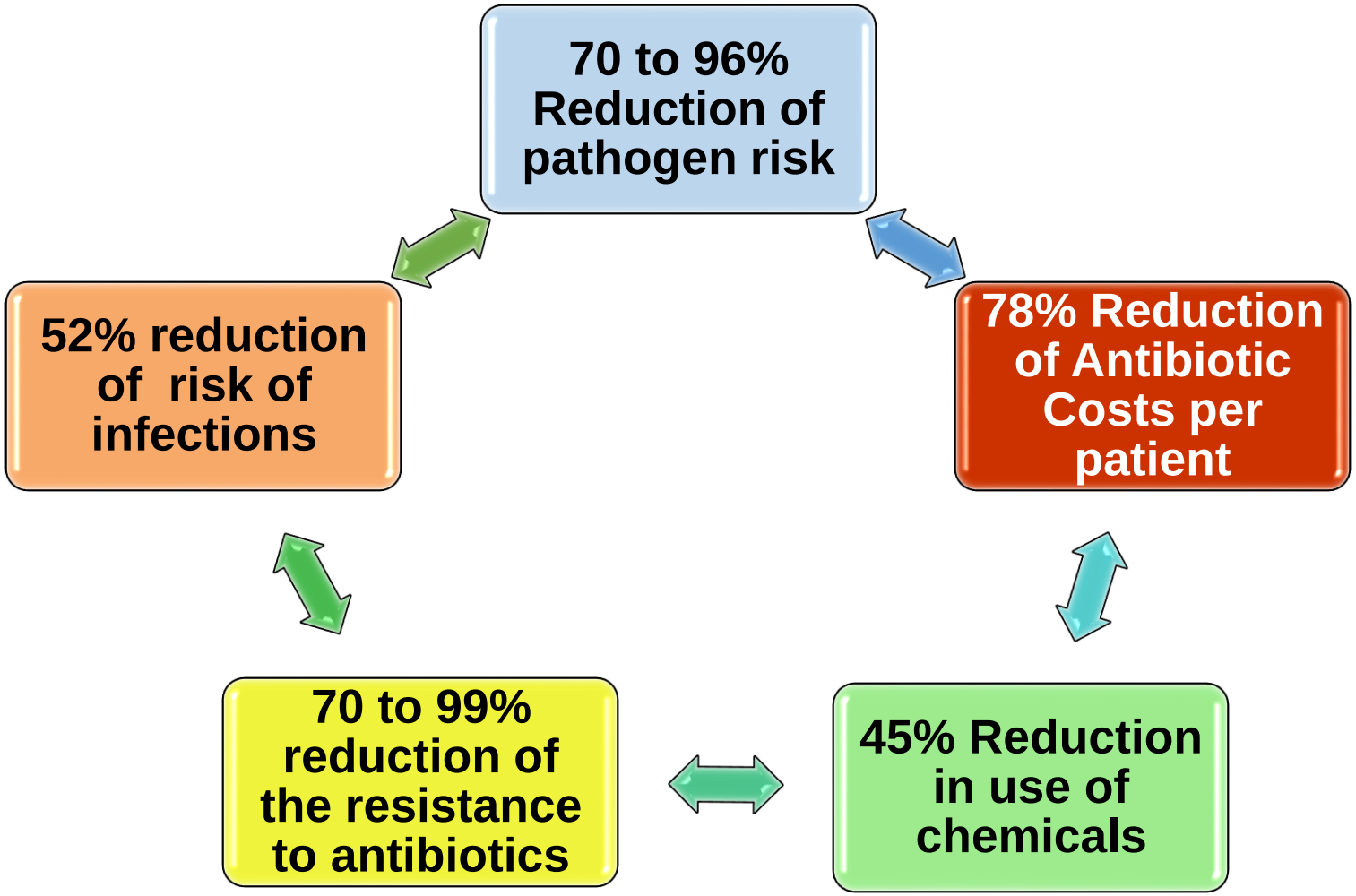
Chrisal
CLEANING PRODUCTS

Number of HAI's (Hospital Acquired Infections)

Type of Infection	Before PIP cleaning N° (%)	PIP Cleaning	Conventional vs PIP Cleaning
Urinary Tract	179 (57%)	70 (49%)	- 60.9%
Blood	54 (17%)	31 (22%)	- 42.6%
Systemic infections	22 (7%)	5 (3.5%)	- 77.3%
Gastrointestinal	17 (5.4%)	6 (4.3%)	- 64.7%
Skin and soft tissues	15 (4.8%)	6 (4.3%)	- 60.0%
Lung infections	22 (7%)	14 (9.9%)	- 36.4%
Reproductive system	1 (0.3%)	-	- 100%
Total	314	141	
Total patients during research	5930	5531	
Incidence of HAI's	314/5930 (5.3%)	141/5531 (2,5%)	- 52.8%

Chrisal
CLEANING PRODUCTS

FIGURES from 2018 Caselli Study



Chrisal
CLEANING PRODUCTS

PLOS ONE

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]¶

1 Section of Microbiology and Medical Genetics, Department of Medical Sciences, University of Ferrara, Ferrara, Italy, **2** CIAS Interdepartmental Research Centre, Departments of Medical Sciences and Architecture, University of Ferrara, Ferrara, Italy, **3** Department of Medicine, University of Udine, Udine, Italy, **4** Fondazione Policlinico Universitario Agostino Gemelli, Roma, Italy, **5** Department of Infection Prevention Control and Risk Management, S. Anna University Hospital, Ferrara, Italy, **6** Centre for Research on Health and Social Care Management (CERGAS), Department of Policy Analysis and Public Management, Bocconi University, Milan, Italy, **7** Department of Public Health, Experimental and Forensic Medicine, University of Pavia, Pavia, Italy, **8** Azienda USL di Ferrara, Ferrara, Italy, **9** Department of Biomedical Sciences and Dental and Functional Images, University of Messina, Messina, Italy, **10** Ospedale di Santa Maria del Prato, Feltre (Belluno), Italy, **11** Azienda Ospedaliera Universitaria Ospedali Riuniti di Foggia, Foggia, Italy, **12** Ospedale Sant'Antonio Abate, Tolmezzo (Udine), Italy

¶ The complete membership of the author group can be found in the Acknowledgements

* csb@unife.it

Check for updates

OPEN ACCESS

Citation: Caselli E, Brusaferro S, Coccagna M, Arnoldo L, Berloco F, Antonioli P, et al. (2018) Reducing healthcare-associated infections incidence by a probiotic-based sanitation system: A multicentre, prospective, intervention study. PLoS ONE 13(7): e0199616. https://doi.org/10.1371/journal.pone.0199616

Editor: John Conly, University of Calgary, CANADA

Received: February 8, 2018

Accepted: June 11, 2018

Published: July 12, 2018

Data Availability Statement: All relevant data are within the paper and its Supporting Information files, including data held in the public repository BioStudies (https://www.ebi.ac.uk/biostudies/), Accession No. S-BSST75.

Funding: The authors declare that they received unrestricted funding from Copma Scrl (via Veneziani 32, 44124 Ferrara, Italy). However, this does not influenced in any way the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation,

Abstract

Healthcare Associated Infections (HAI) are a global concern, further threatened by the increasing drug resistance of HAI-associated pathogens. On the other hand, persistent contamination of hospital surfaces contributes to HAI transmission, and it is not efficiently controlled by conventional cleaning, which does not prevent recontamination, has a high environmental impact and can favour selection of drug-resistant microbial strains. In the search for effective approaches, an eco-sustainable probiotic-based cleaning system (Probiotic Cleaning Hygiene System, PCHS) was recently shown to stably abate surface pathogens, without selecting antibiotic-resistant species. The aim of this study was to determine whether PCHS application could impact on HAI incidence. A multicentre, pre-post interventional study was performed for 18 months in the Internal Medicine wards of six Italian public hospitals (January 1st 2016—June 30th 2017). The intervention consisted of the substitution of conventional sanitation with PCHS, maintaining unaltered any other procedure influencing HAI control. HAI incidence in the pre and post-intervention period was the main outcome measure. Surface bioburden was also analyzed in parallel. Globally, 11,842 patients and 24,875 environmental samples were surveyed. PCHS was associated with a significant decrease of HAI cumulative incidence from a global 4.8% (284 patients with HAI over 5,930 total patients) to 2.3% (128 patients with HAI over 5,531 total patients) (OR = 0.44, CI 95% 0.35–0.54) (P<0.0001). Concurrently, PCHS was associated with a stable decrease of

Caselli et al. 2018

Summary:

11,842 patients and 24,875 surface samples were analyzed

1. **Probiotic cleaning reduced the risk of (studied) pathogens on surfaces by 83%**
2. **No acquired antibiotic resistance was found among the probiotic Bacillus species meaning that the probiotics do not develop or transfer resistance. Furthermore, up to 2 log (= 100x) less antibiotic resistance genes were detected among the pathogens.**
3. **Probiotic cleaning resulted in 54,8% less hospital acquired infections.**

Chrisal CLEANING PRODUCTS

OPEN ACCESS Freely available online

PLOS ONE

Hard Surface Biocontrol in Hospitals Using Microbial-Based Cleaning Products

Alberta Vandini[1], Robin Temmerman[2,3], Alessia Frabetti[1], Elisabetta Caselli[4], Paola Antonioli[5], Pier Giorgio Balboni[4], Daniela Platano[6], Alessio Branchini[7], Sante Mazzacane[1]*

1 CIAS Laboratory, Centre for the Study of physical, chemical and microbiological Contamination of Highly Sterile Environments, Department of Architecture, University of Ferrara, Ferrara, Italy, **2** Laboratory of Microbial Ecology and Technology, Ghent University, Ghent, Belgium, **3** Chrisal R & D Department, Lommel, Belgium, **4** Department of Medical Sciences, Microbiology Section, University of Ferrara, Ferrara, Italy, **5** Department of Infection Prevention Control and Risk Management, Ferrara University Hospital, Ferrara, Italy, **6** Department of Biomedical and Neuromotor Sciences, University of Bologna, Bologna, Italy, **7** Department of Life Sciences and Biotechnology, University of Ferrara, Ferrara, Italy

Abstract

Background: Healthcare-Associated Infections (HAIs) are one of the most frequent complications occurring in healthcare facilities. Contaminated environmental surfaces provide an important potential source for transmission of many healthcare-associated pathogens, thus indicating the need for new and sustainable strategies.

Aim: This study aims to evaluate the effect of a novel cleaning procedure based on the mechanism of biocontrol, on the presence and survival of several microorganisms responsible for HAIs (i.e. coliforms, *Staphyloccus aureus*, *Clostridium difficile*, and *Candida albicans*) on hard surfaces in a hospital setting.

Methods: The effect of microbial cleaning, containing spores of food grade *Bacillus subtilis*, *Bacillus pumilus* and *Bacillus megaterium*, in comparison with conventional cleaning protocols, was evaluated for 24 weeks in three independent hospitals (one in Belgium and two in Italy) and approximately 20000 microbial surface samples were collected.

Results: Microbial cleaning, as part of the daily cleaning protocol, resulted in a reduction of HAI-related pathogens by 50 to 89%. This effect was achieved after 3–4 weeks and the reduction in the pathogen load was stable over time. Moreover, by using microbial or conventional cleaning alternatively, we found that this effect was directly related to the new procedure, as indicated by the raise in CFU/m^2 when microbial cleaning was replaced by the conventional procedure. Although many questions remain regarding the actual mechanisms involved, this study demonstrates that microbial cleaning is a more effective and sustainable alternative to chemical cleaning and non-specific disinfection in healthcare facilities.

Conclusions: This study indicates microbial cleaning as an effective strategy in continuously lowering the number of HAI-related microorganisms on surfaces. The first indications on the actual level of HAIs in the trial hospitals monitored on a continuous basis are very promising, and may pave the way for a novel and cost-effective strategy to counteract or (bio)control healthcare-associated pathogens.

Citation: Vandini A, Temmerman R, Frabetti A, Caselli E, Antonioli P, et al. (2014) Hard Surface Biocontrol in Hospitals Using Microbial-Based Cleaning Products. PLoS ONE 9(9): e108598. doi:10.1371/journal.pone.0108598

Editor: Gabriele Berg, Graz University of Technology (TU Graz), Austria

Received May 25, 2014; **Accepted** August 23, 2014; **Published** September 26, 2014

Data Availability: The authors confirm that all data underlying the findings are fully available without restriction. All relevant data are within the paper and its Supporting Information files.

Funding: This research was financially supported by COPMA scrl, Chrisal NV and the Flemish Institute for the Promotion of Innovation by Science and Technology (IWT - Vlaanderen, Brussels, Belgium). The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Competing Interests: The authors declare that they received funding from the Copma scrl commercial company, and that Dr. Robin Temmerman is affiliated to a commercial funder of this study (Chrisal, Lommel, Belgium). This does not alter the authors' adherence to PLOS ONE policies on sharing data and materials.

* Email: sante.mazzacane@unife.it

Introduction

Healthcare-Associated Infections (HAIs) are one of the most frequent complications occurring in healthcare facilities and represent a problematic concern regarding the safety and quality of healthcare worldwide [1], as also stated in a recent report by the World Health Organization estimating hospital-wide prevalence in high-income countries at 8% [2]. The European Center for Disease Control point prevalence study confirmed that healthcare-associated infections are a major public health problem in Europe with a prevalence of 5.7% (4.5–7.4%) which means 81.089 (64.624–105.895) patients with one HAI for each day in European acute care hospitals [3]. In particular, this European survey reported a similar estimation of nosocomial infections for Italy and Belgium, where the percentage of patients with HAIs has been calculated as 6.3% (5.4–7.4%) and 7.1% (6.1–8.3%), respectively [1]. Based on this study, the estimated total annual number of patients with an HAI in European acute care hospitals in 2011–2012 was 3.2 million, albeit with a wide confidence interval from

Vandini et al. 2014

"This study demonstrates that microbial (probiotic-based) cleaning is more effective in the long-term lowering of the number of HAI-related microorganisms on surfaces, when compared to conventional cleaning products, even those containing disinfectant molecules such as chlorine."

Chrisal
CLEANING PRODUCTS

PLOS | ONE

RESEARCH ARTICLE

Impact of a Probiotic-Based Cleaning Intervention on the Microbiota Ecosystem of the Hospital Surfaces: Focus on the Resistome Remodulation

Elisabetta Caselli[1,2]*, Maria D'Accolti[1,2], Alberta Vandini[2,5], Luca Lanzoni[2], Maria Teresa Camerada[2,5], Maddalena Coccagna[2], Alessio Branchini[3], Paola Antonioli[4], Pier Giorgio Balboni[2], Dario Di Luca[1,2], Sante Mazzacane[2]

1 Section of Microbiology and Medical Genetics, Department of Medical Sciences, University of Ferrara, Ferrara, Italy, **2** CIAS Interdepartmental Research Center for pollution control in high sterility rooms, University of Ferrara, Ferrara, Italy, **3** Section of Biochemistry and Molecular Biology, Department of Life Sciences and Biotechnology, University of Ferrara, Ferrara, Italy, **4** Department of Infection Prevention Control and Risk Management, S. Anna University Hospital, Ferrara, Italy, **5** Architecture and Urban Planning (XXX cycle), Department of Architecture, University of Ferrara, Ferrara, Italy

* elisabetta.caselli@unife.it

OPEN ACCESS

Citation: Caselli E, D'Accolti M, Vandini A, Lanzoni L, Camerada MT, Coccagna M, et al. (2016) Impact of a Probiotic-Based Cleaning Intervention on the Microbiota Ecosystem of the Hospital Surfaces: Focus on the Resistome Remodulation. PLoS ONE 11(2): e0148857. doi:10.1371/journal.pone.0148857

Editor: Yung-Fu Chang, Cornell University, UNITED STATES

Received: December 4, 2015

Accepted: January 25, 2016

Published: February 17, 2016

Data Availability Statement: All relevant data are within the paper and its Supporting Information files.

Funding: This study was financially supported by COPMA scrl (Ferrara, Italy). The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Competing Interests: The authors declare that they have received funding by the commercial company Copma scrl. This does not alter the authors' adherence to PLOS ONE policies on sharing data and materials.

Abstract

Background

Contamination of hospital surfaces by clinically-relevant pathogens represents a major concern in healthcare facilities, due to its impact on transmission of healthcare-associated infections (HAIs) and to the growing drug resistance of HAI-associated pathogens. Routinely used chemical disinfectants show limitations in controlling pathogen contamination, due to their inefficacy in preventing recontamination and selection of resistant strains. Recently we observed that an innovative approach, based on a cleanser added with spores of non-pathogenic probiotic *Bacilli*, was effective in stably counteracting the growth of several pathogens contaminating hospital surfaces.

Methods

Here, we wanted to study the impact of the *Bacillus*-based cleanser on the drug-resistance features of the healthcare pathogens population. In parallel, the ability of cleanser-derived *Bacilli* to infect hospitalized patients was also investigated.

Results

Collected data showed that *Bacilli* spores can germinate on dry inanimate surfaces, generating the bacterial vegetative forms which counteract the growth of pathogens and effectively substitute for them on treated surfaces. Strikingly, this procedure did not select resistant species, but conversely induced an evident decrease of antibiotic resistance genes in the contaminating microbial population. Also importantly, all the six HAI-positive

Caselli et al. 2016a

"Probiotic Bacillus strains, best known for their usefulness as food supplements or fungicides, can be also successfully exploited in sanification procedures, as they counteract the growth of pathogens and, most importantly, they decrease the population harboring drug resistance genes, which is a global concern and which is ultimately responsible for the onset of the most severe HAIs."

Chrisal
CLEANING PRODUCTS

Journal of Hospital Infection 94 (2016) 193–208

Available online at www.sciencedirect.com

Journal of Hospital Infection

journal homepage: www.elsevierhealth.com/journals/jhin

Letters to the Editor

Safety of probiotics used for hospital environmental sanitation

Sir,

There is consensus about the need for efficient control of microbial contamination on hospital surfaces, as these surfaces represent significant pathogen reservoirs that may contribute to transmission of healthcare-associated infections (HCAIs). The emergence of multidrug-resistant pathogens in hospitals is a global concern.[1]

Control of surface bioburden is routinely addressed by use of conventional chemical-based detergents/disinfectants; however, these are ineffective in preventing recontamination, and may select resistant strains. Recently, cleaning agents containing probiotics of the genus *Bacillus* have been proposed for hospital sanitation [Probiotic Cleaning Hygiene System (PCHS); Copma srl, Ferrara, Italy]; these have been shown to stably decrease surface pathogens up to 90% more than conventional disinfectants, and to be genetically stable even after years of continuous contact with surface pathogens.[2,3] The rationale for the use of probiotics as sanitizing agents lies in the idea that a healthy microbiota might protect against colonization by, and expansion of, pathogens in the environment as well as in the human body; this has been called 'bidirectional' hygiene.[4]

The three species contained in the probiotic cleansers (*Bacillus subtilis*, *Bacillus pumilus*, and *Bacillus megaterium*) are considered non-pathogenic for humans.[5] Nevertheless, a theoretical risk of infection exists, and a few anecdotal cases of infection by *B. subtilis* have been reported in surgical patients.[5] However, systematic assessment of adverse events in probiotic intervention studies is lacking, whereas it has recently been proposed that the most appropriate way to investigate whether probiotics are safe is to use the 'totality of evidence' rather than single case reports.[6,7] Active surveillance for cases of probiotic-associated infection in all probiotic-based trials has been advocated.[8] Thus, we have analysed whether the *Bacillus* spp. included in cleaning products may themselves be a source of HCAIs. We investigated whether any infections with *Bacillus* spp. occurred in seven healthcare institutions in the province of Ferrara (Italy) that used the PCHS throughout.

In addition to routine culture of all 32,139 clinical samples from around 90,000 patients and 800,000 hospitalization days, a quota of samples was also analysed by a *Bacillus*-specific real-time quantitative polymerase chain reaction, as previously described.[2] The numbers of analysed samples from each institution, as well as the period of environmental sanitation by PCHS, are shown in Table I. Both culture-based and molecular testing showed complete absence of PCHS-derived bacilli in any clinical sample, for the entire period of the survey. This suggests that probiotic *Bacillus* spp. do not cause infections, even in the subjects at high risk of opportunistic infections.

We think that this surveillance model represents an essential part of the infection control policy associated with the use of probiotics, as it provides ongoing assurance of safety. Accordingly, we are now undertaking a multi-centre study to evaluate a larger number of healthcare institutions for a prolonged period.

Table I
Analyses performed in the years 2011–2015 in the healthcare structures (HS) continuously using the *Bacillus*-based Probiotic Cleaning Hygiene System (PCHS)

Healthcare structures	Analyses per year (with PCHS sanitation system)					Total analyses (per HS)
	2011	2012	2013	2014	2015	
HS-1	429	–	–	–	–	429
HS-2	103	704	701	613	765	2886
HS-3	–	–	6346	7290	7593	21,229
HS-4	–	76	1025	969	1154	3224
HS-5	–	72	631	713	750	2166
HS-6	–	240	403	498	554	1695
HS-7	–	–	–	–	510	510[a]
Total[b]	532	1092	9106	10,083	11,326	32,139

HS-1, Old S. Anna Hospital (Ferrara), PCHS application March 16th to August 28th, 2011; HS-2, S. Giorgio Hospital (Ferrara), PCHS application since November 1st, 2011; HS-3, New S. Anna Hospital (Cona, Ferrara), PCHS application since January 1st, 2013; HS-4, Delta Hospital (Lagosanto, Ferrara), PCHS application since June 1st, 2012; HS-5, Cento Hospital (Cento, Ferrara), PCHS application since July 1st, 2012; HS-6, Argenta Hospital (Argenta, Ferrara), PCHS application since July 1st, 2012; HS-7, Quisisana Hospital (Ferrara), PCHS application since January 1st, 2015.

[a] A quota of these samples was simultaneously analysed also by molecular assays (qPCR).

[b] A unique central Microbiology Laboratory (S. Anna University Hospital, Ferrara) performed the analyses by conventional microbiological assays.

Caselli et al. 2016b

"This suggests that probiotic Bacillus spp. do not cause infections, even in the subjects at high risk of opportunistic infections."

Chrisal CLEANING PRODUCTS

Criteria for Probiotic Cleaners

Quality challenges associated with microbial-based cleaning products from the Industry Perspective Steve M.Teasdale Ali Kademi

https://doi.org/10.1016/j.fct.2017.10.029

Abstract

Microbial-based cleaning products (MBCPs) continue to gain popularity… Although the microorganisms used in MBCPs are subject to regulation in Canada under the Canadian Environmental Protection Act, the products themselves are not…

...**the use, manufacture and quality parameters of MBCPs in Canada and other countries are poorly defined and not specific…these products feature unique quality challenges.**

… A good understanding of the mechanisms …and manufacture are ….essential for achieving high-quality performance standards

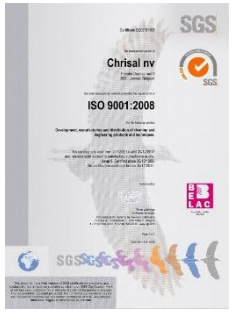
Status of microbial based cleaning products in statutory regulations and ecolabelling in Europe, the USA, and Canada ArminSpök[a] GeorgeArvanitakis[b2] GwendolynMcClung[c1]
https://doi.org/10.1016/j.fct.2017.12.057

Chrisal CLEANING PRODUCTS

Assessing Quality of Probiotic Cleaners

Probiotic cleaning products require quality criteria:

- **Type of probiotics used - not all are effective**
- **Number of probiotics - enough are needed**
- **Shelf-life - the products needs to be stable**
- **Quality control - the products need to be pure**



Development and use of microbial-based cleaning products (MBCPs): Current issues and knowledge gaps

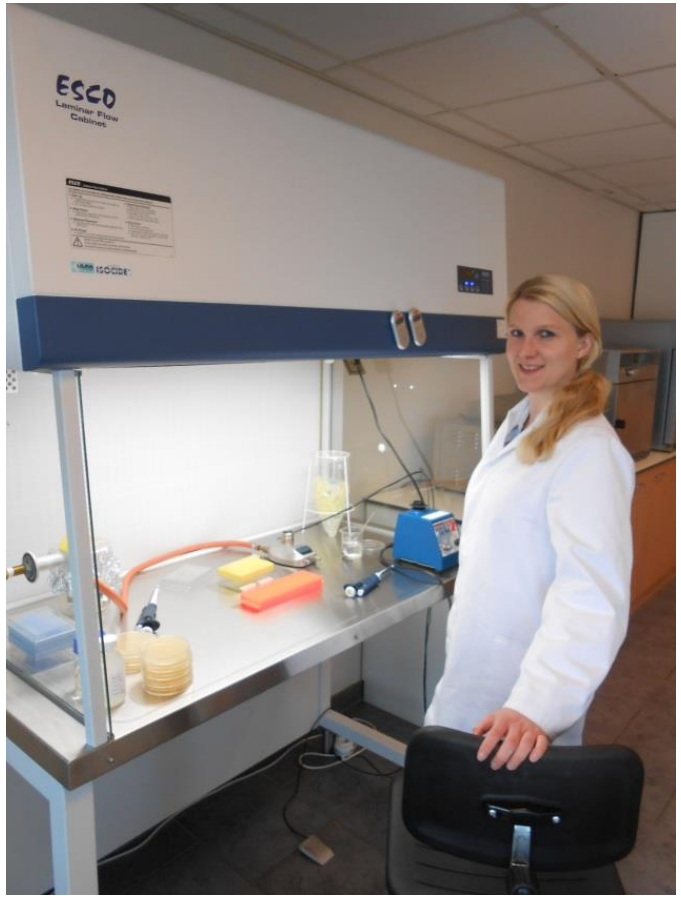
GeorgeArvanitakis[a] RobinTemmerman[b] ArminSpök[c] https://doi.org/10.1016/j.fct.2017.12.032

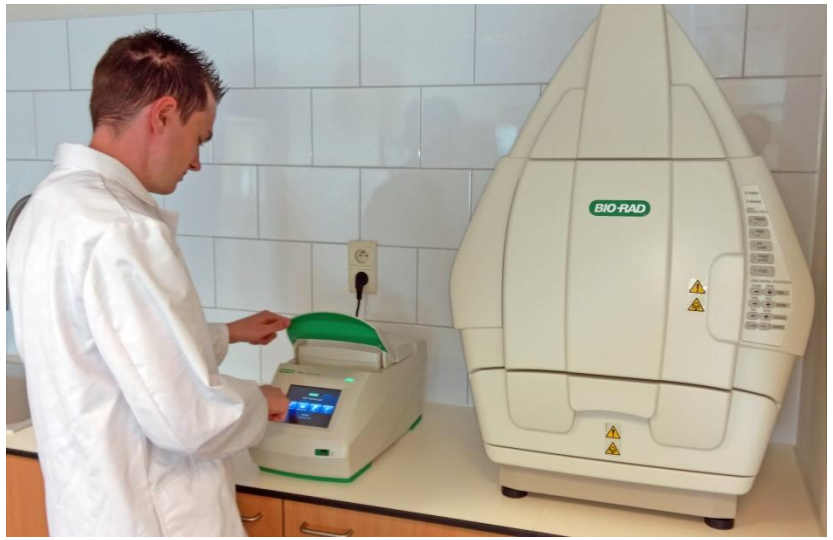
Chrisal CLEANING PRODUCTS

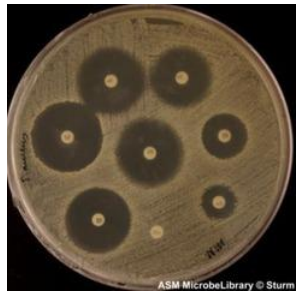
Chrisal R&D

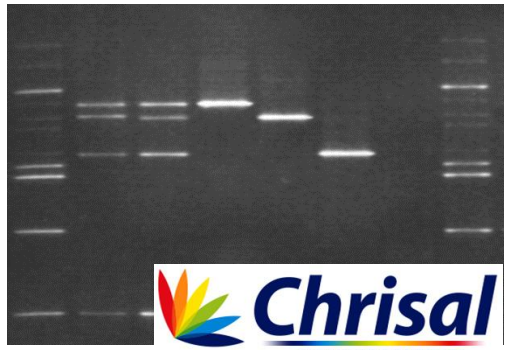
- Quality Control
- Product development
- Customer services

Raw materials and production batches
New formulations and applications
Field trials and sampling









WE MUST LEARN HOW TO SPEAK TO OUR BIOLOGY WITHOUT TOXIC CHEMICALS

PIP uses naturally occurring biological principles to:

- improve cleaning efficacy
- reduce odours
- remove biofilm
- lower pathogen presence
- decrease cross contamination
- reduce toxicity of waste water
- reduce allergens
- improve air quality
- reverse chemical resistance genes in pathogens.

Best of all, probiotic cleaners effectively and easily fit into an infection control strategy!

Chrisal
CLEANING PRODUCTS

Presentation Review

Probiotics in Progress "PIP"

- **What is a probiotic cleaner?**
- **Where are they used?**
- **Why are they used?**
- **How do they work?** mechanisms of action
- **Efficacy - historical & present day research**

➢ **Discussion/Questions –Implementation & Use**

Chrisal
CLEANING PRODUCTS

Implementation & Use

Chrisal CLEANING PRODUCTS

Probiotics In Progress

PIP Healthcare Custodial Chart

PRODUCT	APPLICATION		INSTRUCTIONS	REMARKS
PIP ALLERGY FREE				
	Spray for textiles, electronics • mattresses, linens, pillows • curtain, charts, personal items • upholstery, cushions, toys • keyboards, phones, desktops • remote controls, electronics Application: DAILY		Ready to use spray can • Spray sparingly over all bedding and electronics • Do not make surfaces wet! • 3 seconds misting per bed is sufficient.	Store product indoors between 10° C –45° C. Spray can under pressure; shield from direct sunlight and temperatures above 50° C. Do not perforate or burn the spray can and keep away from open flame or heat sources. Keep out of reach of children. pH: 6.5
PIP INTERIOR CLEANER or ECONOMIC PRO				
	Universal Cleaner for: • furniture and fixtures • door handles, hand rails • windows, glass • floors Application: DAILY		Concentrated Product: • Shake before using • Dilute 1:100 *(10 ml. product / liter water)* *(1 oz. product/gallon water)* Use with spray bottle or cloth and bucket.	Store product indoors between 10° C –45° C shielded from direct sunlight. Diluted product to be used within 5 days, any leftovers need to be discarded through the drain. pH: 8.5
PIP INTERIOR or ECONOMIC PRO				
	Universal Cleaner for: • shower, bathtub • toilet • sink • Mirrors • floors Application: DAILY		Concentrated Product: • Shake before using • Dilute 1:100 *(10 ml. product / liter water)* *(1 oz. product/gallon water)* Use with spray bottle or cloth and bucket.	Store product indoors between 10° C –45° C shielded from direct sunlight. Diluted product to be used within 5 days, any leftovers need to be discarded through the drain. pH: 8.5
PIP FLOOR CLEANER or ECONOMIC PRO				
	Floor Cleaner for: • all water proof floors • carpets Application: DAILY		Manual cleaning with mops: • Shake before use • Dilute 1:100 *(10 ml. product / liter water)* *(1 oz. product/gallon water)* **Auto scrubber / floor machines** • Shake and dilute as above • Use defoamer in return tanks	Store product indoors between 10° C –45° C shielded from direct sunlight. Diluted product to be used within 5 days, any leftovers need to be discarded through the drain. pH: 8.4
PIP SANIGEL				
	Ready to use Gel Spray for: • toilet bowls, urinals • bed pans • tenacious debris Application: WEEKLY		**Ready to use product:** • Spray on the surface • Leave to work for 10 min. • Do not rinse when used in bed pans, toilet bowls or urinals • Do rinse when used on any other surface	Store product indoors between 10° C –45° C shielded from direct sunlight. pH: 7.5
ORGANIC DESCALER				
	Descaler for: • Sinks • showers • toilets Application: WEEKLY		**Dilutions for:** • Weekly cleaning: *100 ml (3.2 oz) of product/liter water* • Periodic cleaning: *300 ml (10 oz) of product/liter water* • Heavy scale or rust: *Use product undiluted, let sit for a few minutes, rinse.* **Do not let dry.**	Store product indoors between 10° C –45° C shielded from direct sunlight. WARNING: irritating to eyes and skin. When swallowed, get medical aid immediately. pH: 7.5

PROBIOTICS IN PROGRESS—Using probiotic bacteria to create safe and healthy environments

www.choiceprobiotics.com

CHOICE PROBIOTICS

QUESTIONS & DISCUSSION

Chrisal CLEANING PRODUCTS

SALES: Tahn Towns
Townst@ choiceprobiotics.com
Cell: 250-485-2360
Choice Probiotics Ltd, Abbotsford, BC

CHOICE PROBIOTICS
THE SAFE NATURAL SOLUTION

Available through

STEVENS
Inspired by the care you deliver