



Strong together against infections  
Science • Society • Industry

## An infection reducing patient room for hospitals

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A large, faint, grey graphic of a stylized human arm and hand, reaching towards the bottom right corner of the slide.

UNTERNEHMEN  
Die BMBF-Innovationsinitiative  
Neue Länder  
REGION



Zukunft  
20  
AUFNEHMEN DER INNOVATION

GEFÖRDERT VOM  
 Bundesministerium  
für Bildung  
und Forschung

# KARMIN

## Krankenhaus-**AR**chitektur, **M**ikrobiom und **IN**fektionen im Krankenhaus

Research on the influence of architecture and design on the transmission of nosocomial infections and multi-resistant pathogens and on the colonization of a new hospital with microorganisms

### Partner

TU Braunschweig (Coordinator)

Charité – Universitätsmedizin Berlin

AG Host Septomics für Infektions- und Mikrobiomforschung,  
Universitätsklinikum Jena

Röhl GmbH, Waldbüttelbrunn



# Single room standard

- Canada:** Nursing ward of the 21st century mostly single rooms
- USA:** Single rooms become the standard
- UK:** 50 % of single rooms required for new buildings
- DK:** New buildings only with single room standard
- NO:** St. Olav Hospital with exclusive Single Rooms
- NL:** Erasmus-Med. Center Rotterdam, excl. single rooms

Van Steelandt et al. Anthropology & Medicine 2015; 22: 149-161

Bobrow/Thomas. John Wiley & Sons 2000; 131-93

Department of Health 2013 Health Building Note 04-01 adult in-patient facilities

Buschbeck et al. Bauwelt 2012; 103: 270412

Bakken B Health Estate 2012; 66: 28-32

Van de Glind et al. Health Policy 2007; 84:153-61

# Study on the availability of single rooms in German Hospitals, Survey in KISS-Hospitals 2015

Ward type	n	Rooms	Beds	Number of patient rooms, Median	Number of beds, Median	Number of beds in single rooms (%)
ICU	534	4134	6817	7	12	<b>27,1 %</b>
Normal Care Ward	621	9921	22189	15	34	<b>6,4 %</b>

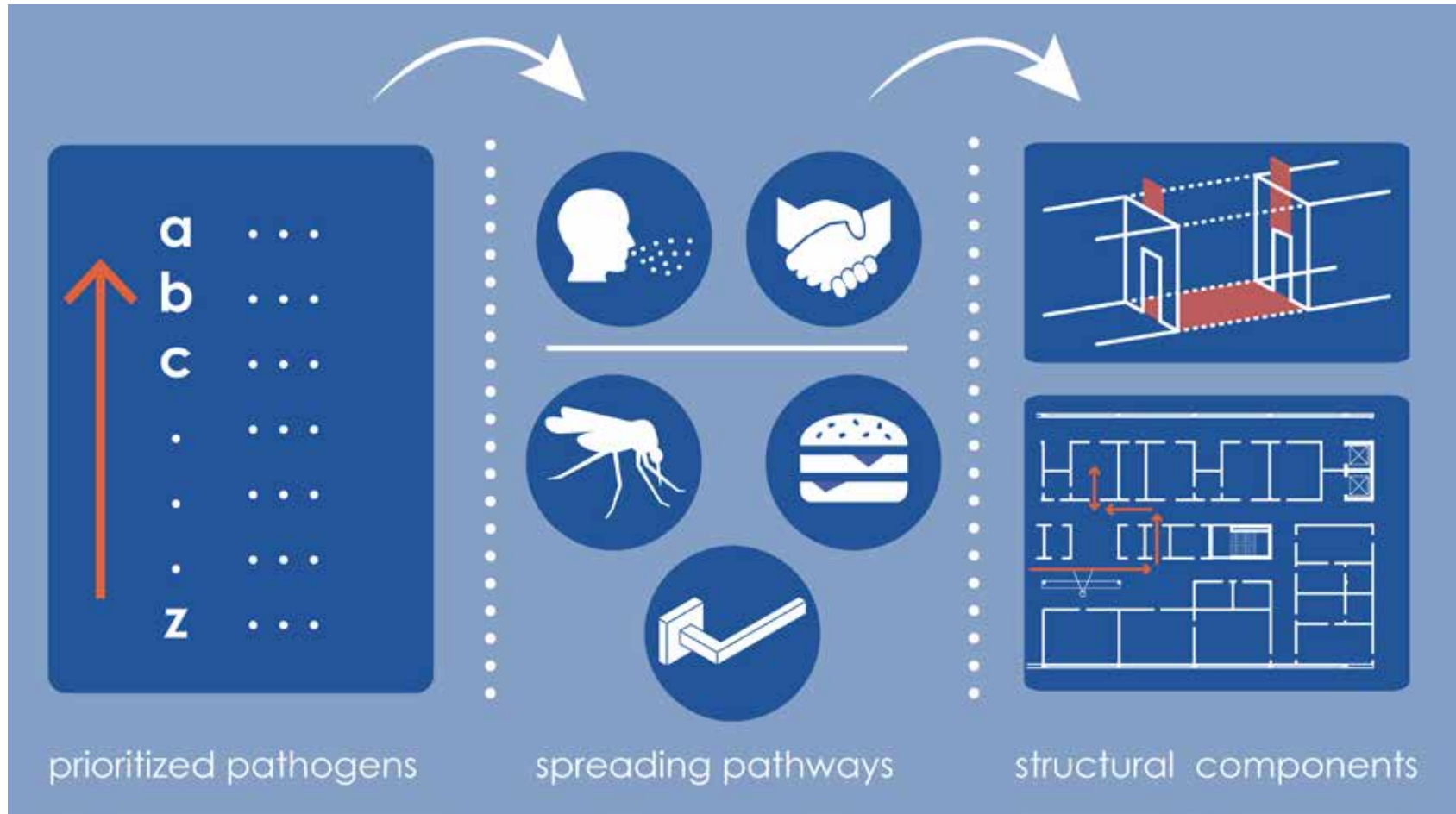
## Questions

Is there a design of a twin room in Normal Care Wards possible, that is an **ALTERNATIVE** to a single room in terms of infection prevention?

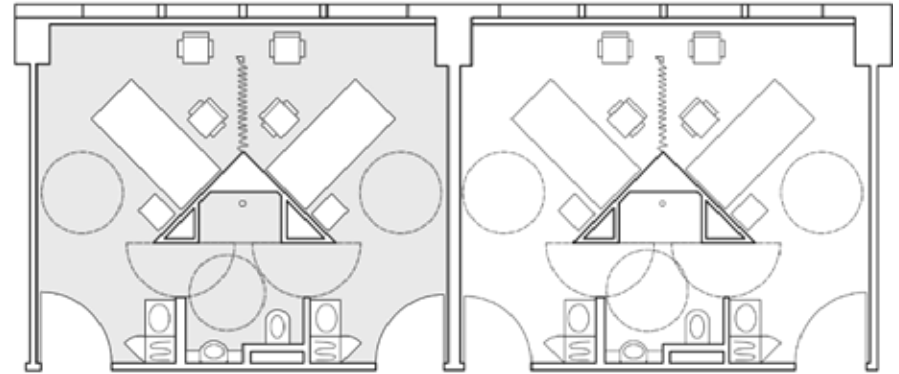
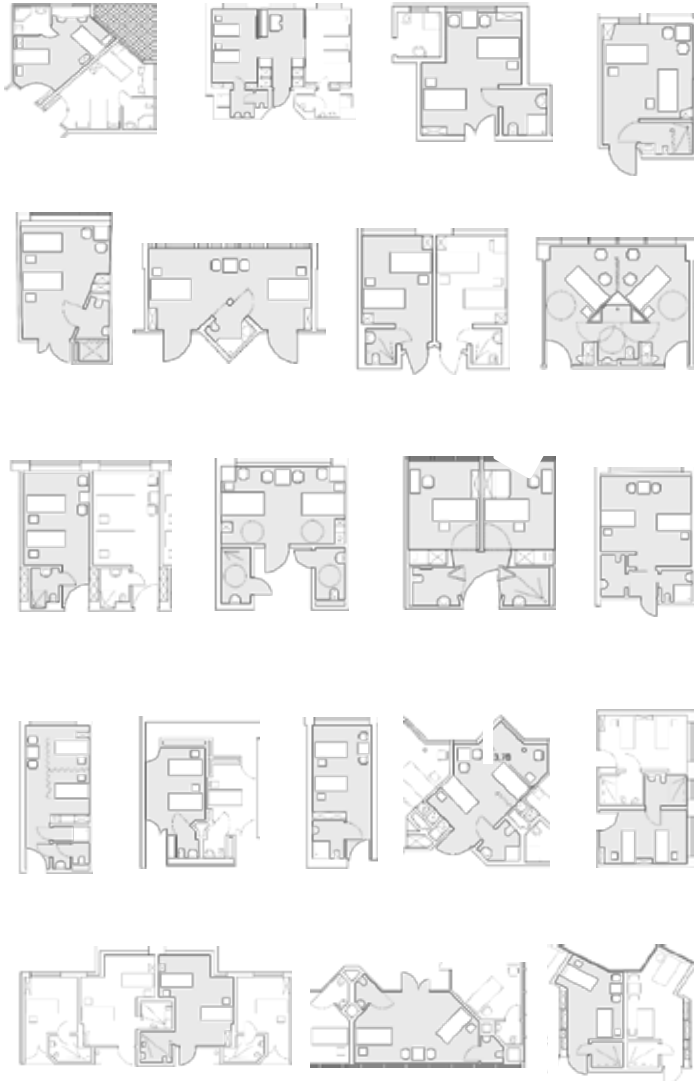
**BUT:** The role of the hospital microbiom is not fully explored so far.

Can research of the hospital microbiom lead to different understanding of single rooms settings and their cleaning/ disinfection?

# Design of an infection reducing patient room



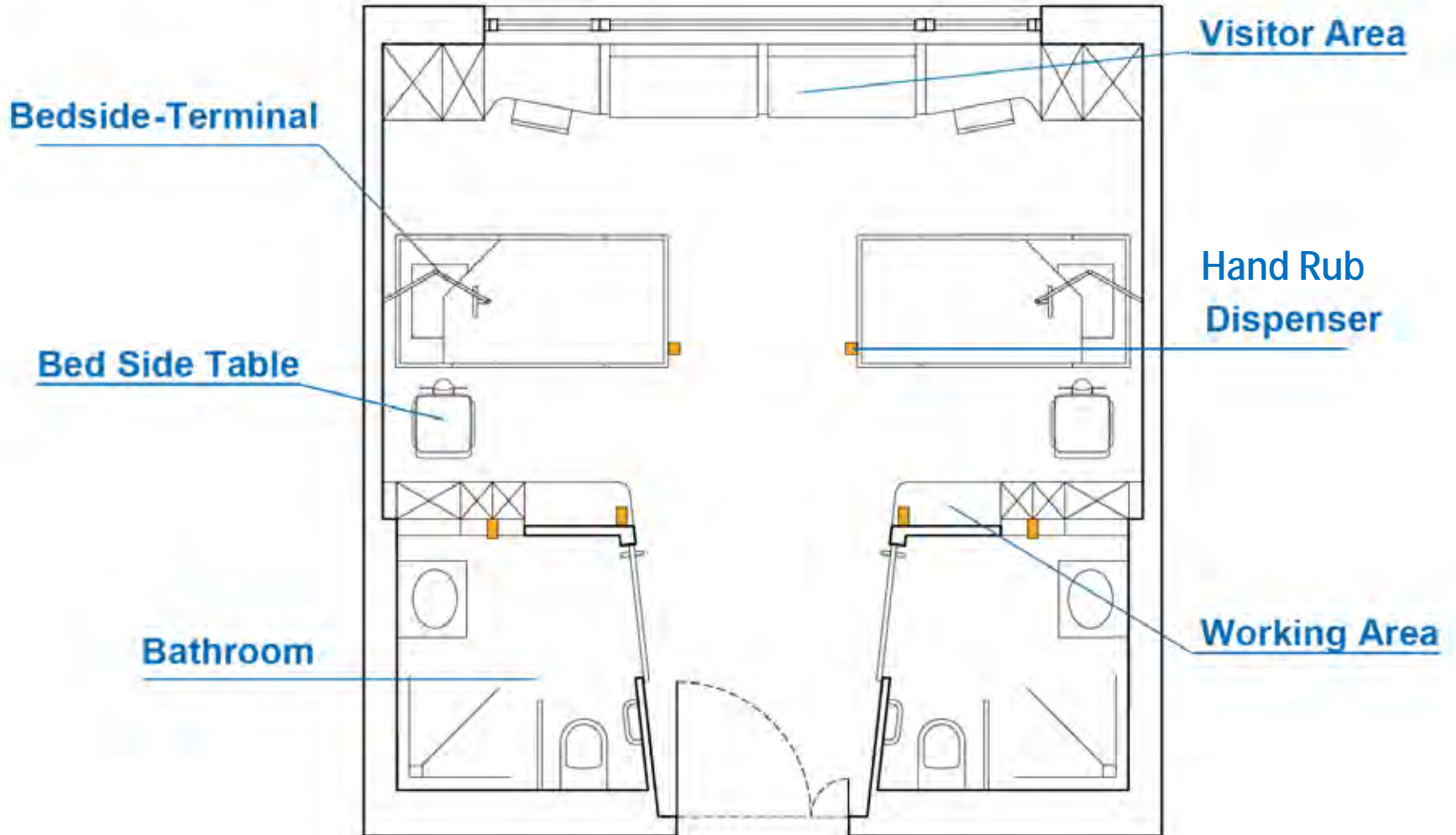
# Typological Evaluation



## Mississauga CA Trillium Health Renovation / Refurbishment 2017

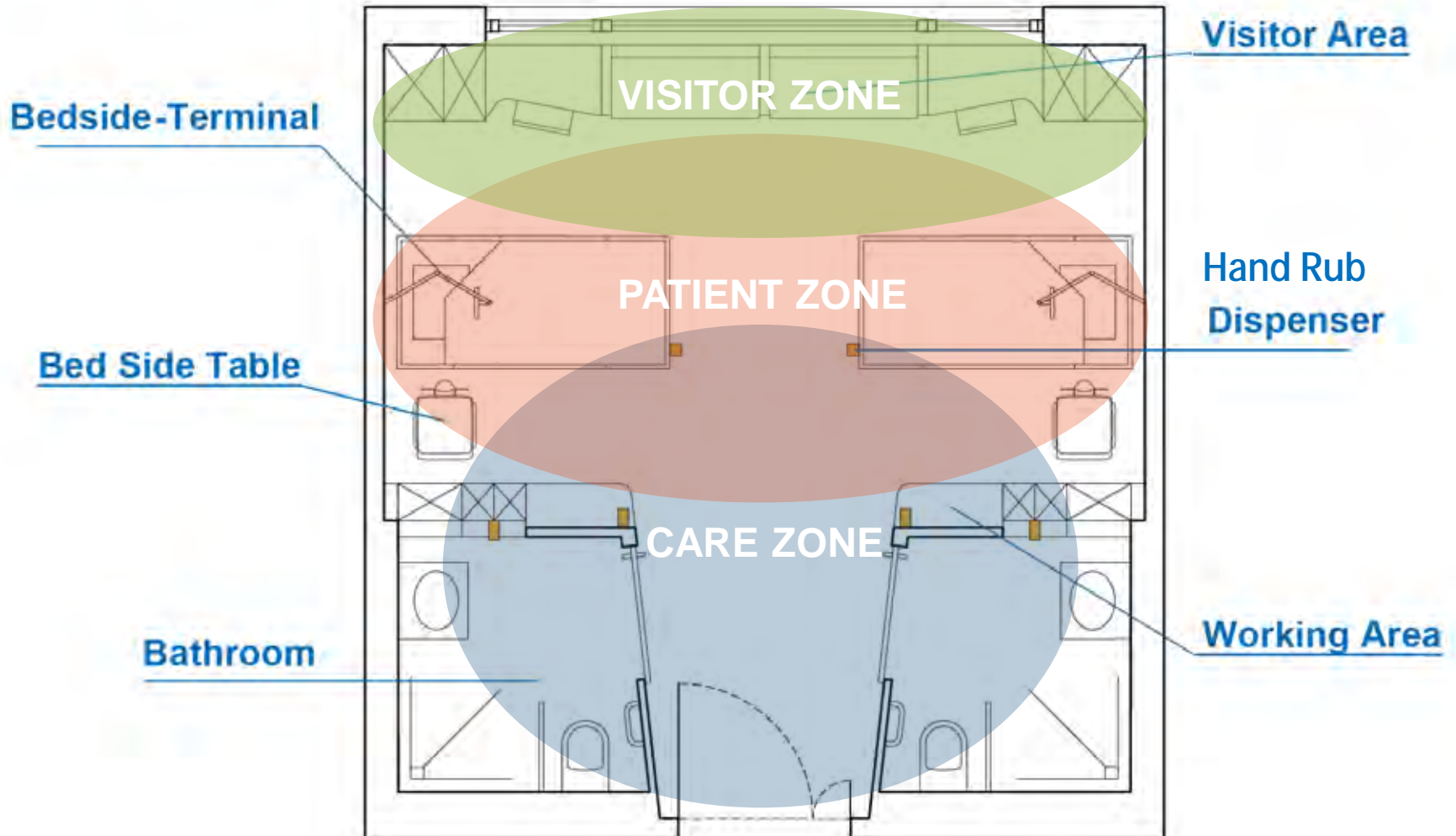


# Layout Patient Room





# Layout Patient Room





Equivalent patient area



Working area close  
to patient



Bathroom for each patient



Hand Rub Dispenser visible and close to bed



Design and material  
for optimize cleaning



Designated storage  
space



# Microbiom:

## Sequence diagram of the longitudinal study

### Environmental room samples



Charité (Neurology Ward) – 9 rooms

#### SAMPLES #

- Environmental: 861
- Patients: 410
- Negative controls: 285

**TOTAL sample #: 1556**

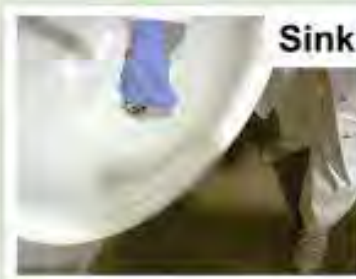
### Sampling



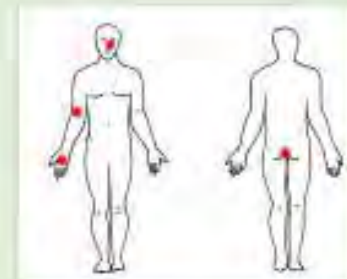
Floor



Doorhandle

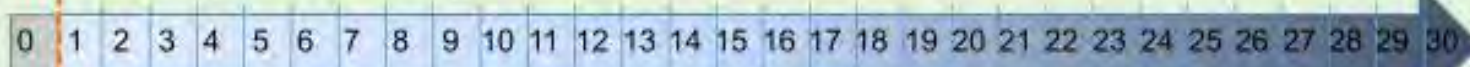


Sink



Patients

### Timeline (30 weeks)



Before | After Patient Occupancy

# Microbiom:

## Sequence diagram of the longitudinal study

### Bacterial profiling

Library construction  
(16S rRNA)



Sequencing  
(Illumina MiSeq)

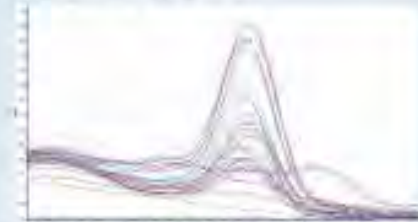


Analysis (Qiime)

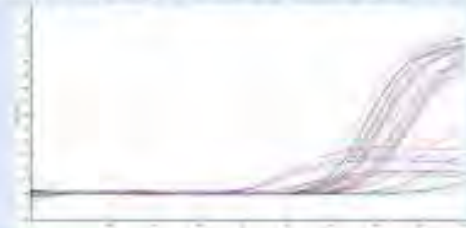


### Quantification/ARG detection

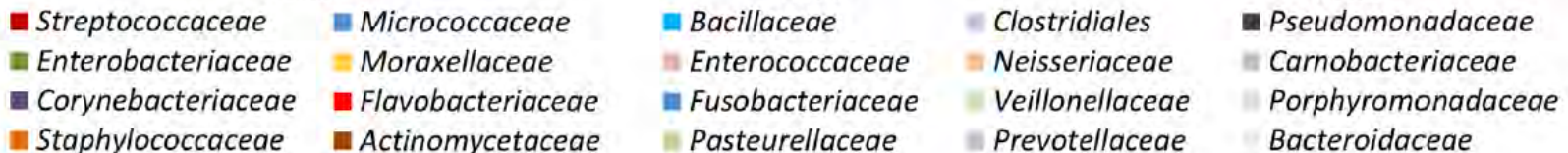
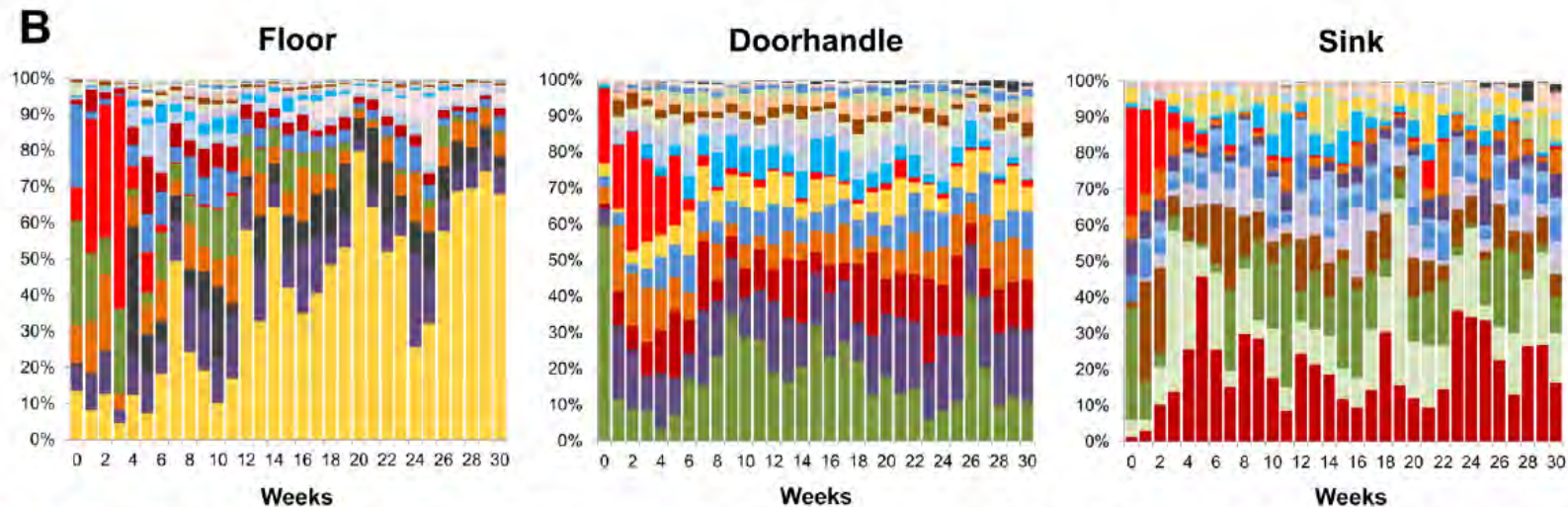
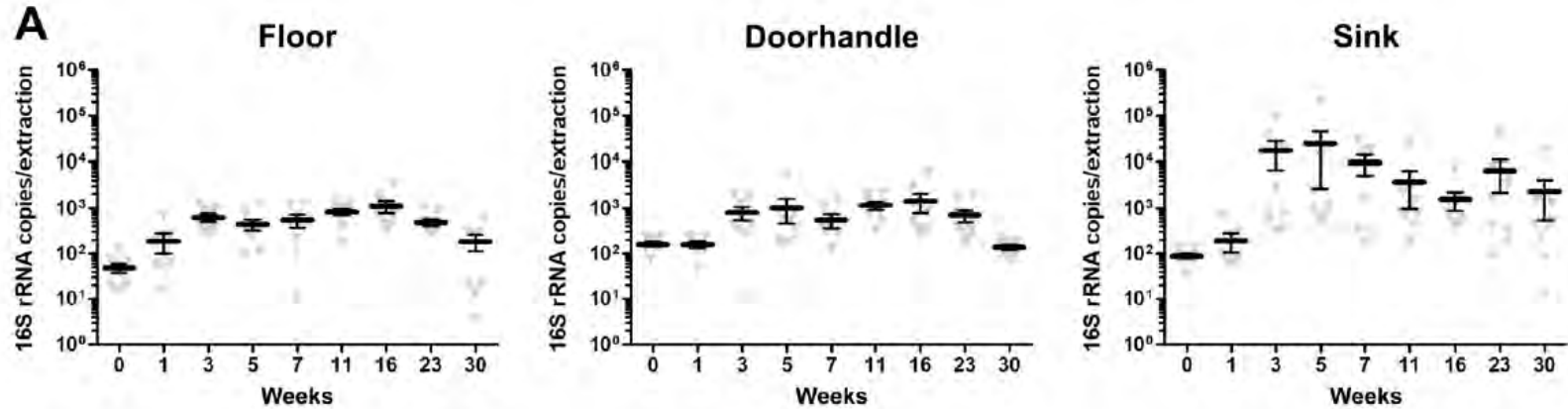
Quantification of bacterial growth  
Culture/qPCR  
(16S rRNA)



Multiplex Taq-Man Assay for ARG detection

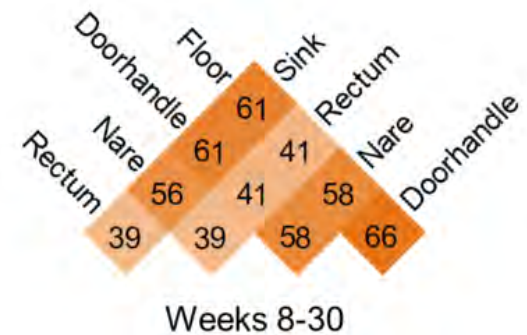
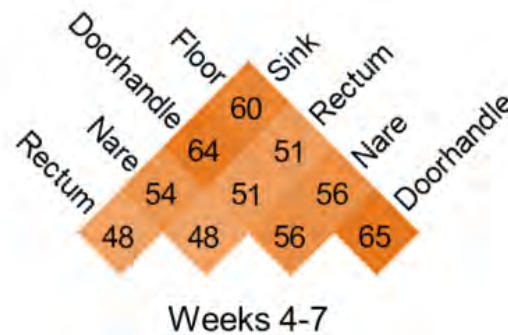
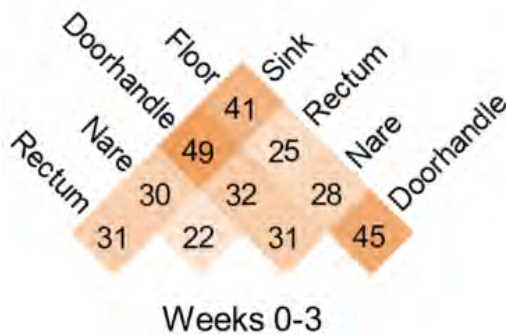
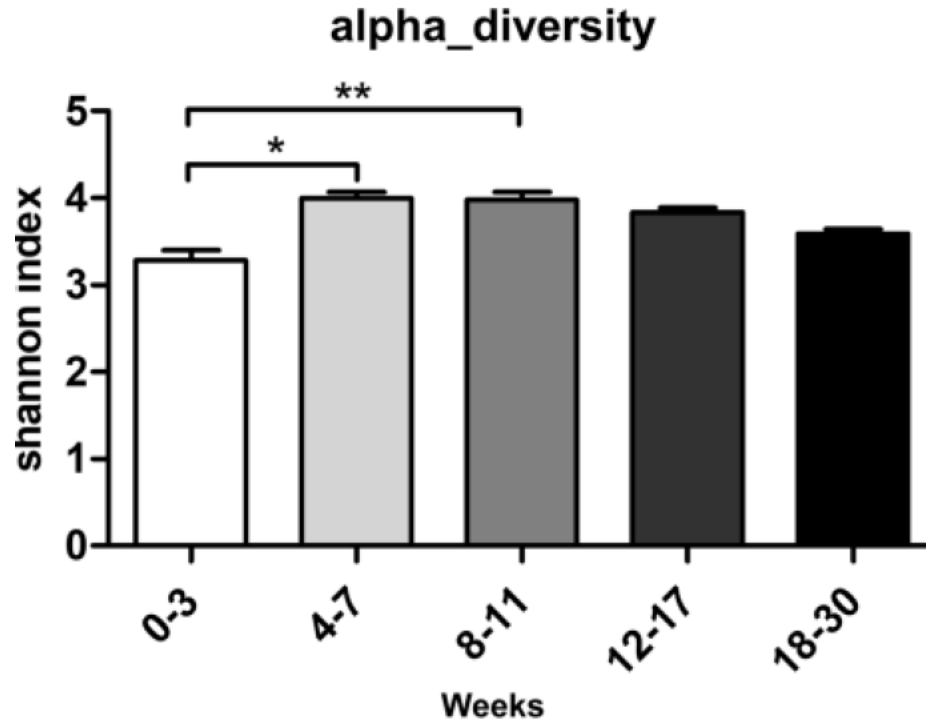


# Bacterial colonization dynamics





# Design language for optimize cleaning





# Acknowledgements



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GEFÖRDERT VOM

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Lars **Röhl**

## EXHIBITION AND EVALUATION

**27.10. – 22.11.2020**

Visit the **KARMIN** patient room on the Charité Campus Berlin Mitte!

For booking: [www.karmin.info](http://www.karmin.info)

