# Hygiene at home – critical aspects and future trends

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# Introduction of Swissatest Testmaterials ag

## Swissatest Testmaterials ag

- **Production and sale of test materials**
  - Washing performance tests (DIN/IEC 60456)
  - Textile testing (ISO 105-F01 etc)
  - Leather testing (ISO/IUF/VESLIC)
- **Development** of tailored, customer-specific test materials
- **Standardisation**

## Caroline Amberg / Rita Marques

- Microbiologists
- Swissatest hygiene department: laundry hygiene, microbiological testing, applied R&D, biofilm formation in household devices and water supply systems, Odour formation on textiles

# Home hygiene – what is it?

**All measures that decrease and prevent infection transmission**

Priority

- **Hand hygiene / Personal hygiene**
- **Food hygiene**
- **Safe water**
- **Safe disposal of faeces**
- **General hygiene (laundry, surfaces, toilets, bath, sink)**
- **Disposal of solid waste**
- **Control of wastewater and rainwater**
- **Situations where there is more risk / Care of infected persons / Care of more vulnerable persons**

# Future trends affecting hygiene at home

Climate change / pollution / resource scarcity

Demographic / social changes

Health

Home hygiene

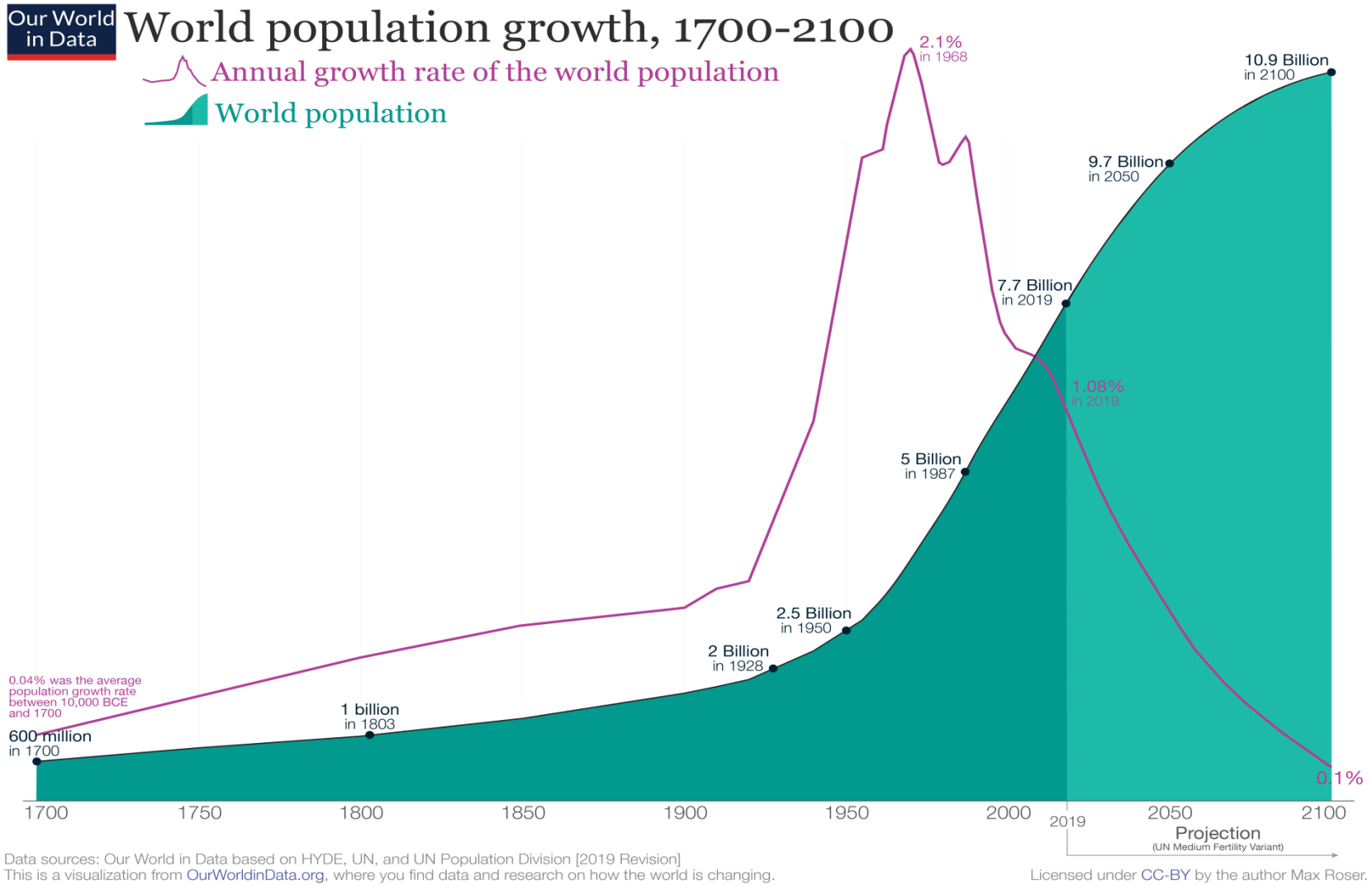
*The best way to predict the future, is to create it!*

*- or to shape it!*

*- or to invent it!*

Abraham Lincoln / Willy Brandt and others in different variations….

# Megatrends: Growing world population



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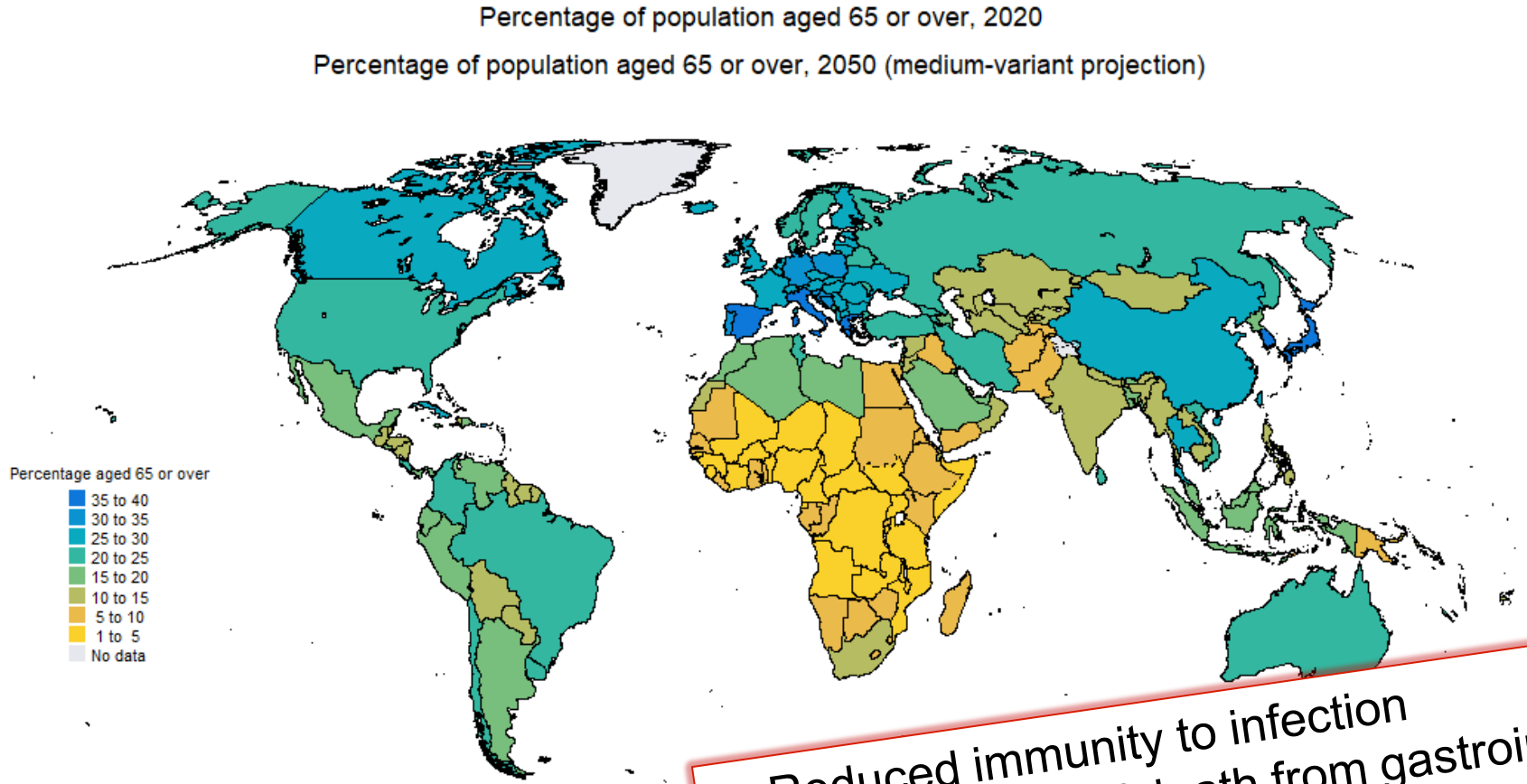
# Megatrends: Aging society / Silver society





Data source: United Nations, DESA, Population Division. *World Population Prospects 2019*. http://population.un.org/wpp/

The designations employed and the presentation of material on this map do not imply the expression of any opinion whatso
or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted line represents approximately the Li
has not yet been agreed upon by the parties. Final boundary between the Republic of Sudan and the Republic of South Sud
Great Britain and Northern Ireland concerning sovereignty over the Falkland Islands (Malvinas).

- Reduced immunity to infection
- Increased risk of death from gastrointestinal disease
- More special care at home



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# Megatrends: Climate change and resource scarcity

Aletsch-Glacier: UNESCO World Heritage site

1856 1908 1980 2050?

**Social dilemma:**
Individual profits and the whole group looses

**Human beeings as rational decision maker?**
- automated, unconscious, ‘emotional’
- rational, conscious

→ Policy change is often the fastest route to individual behaviour change!




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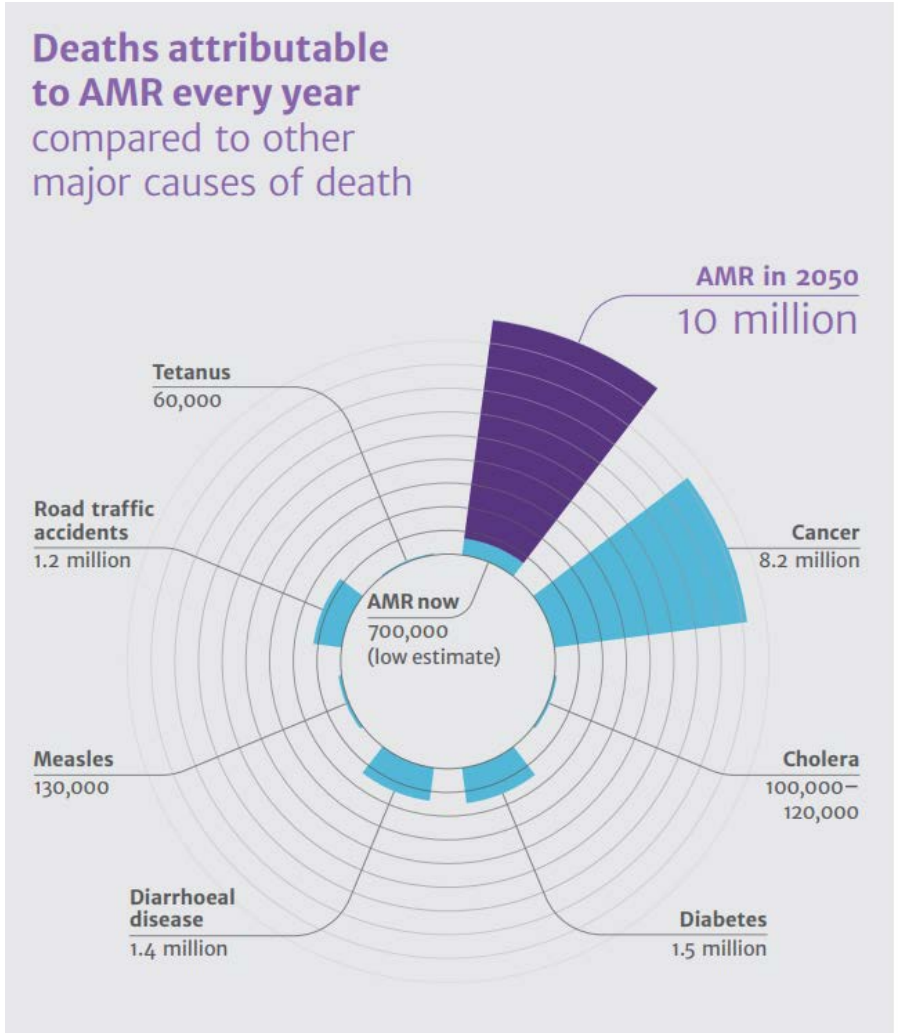
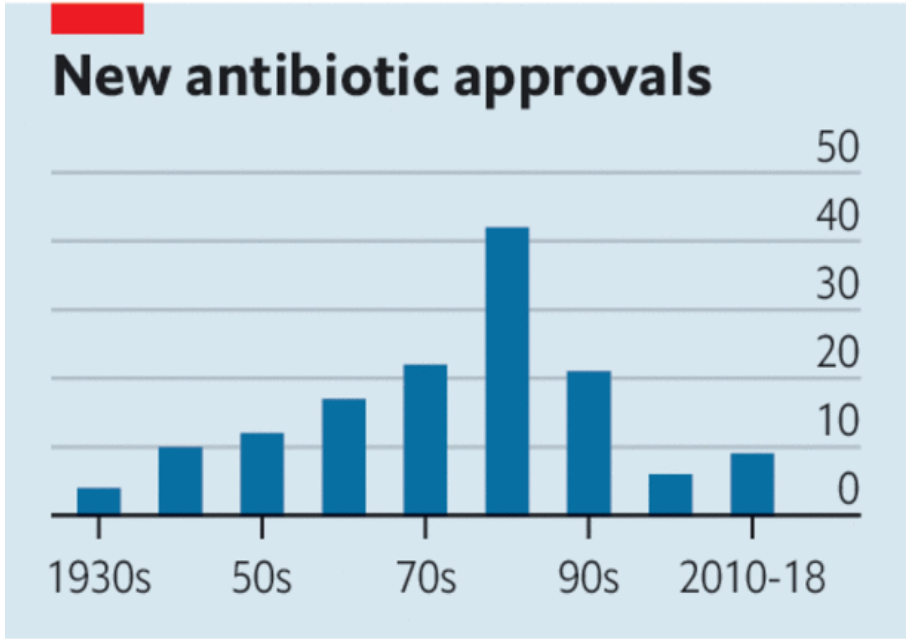
# Megatrends: Antibiotic resistances




Health

- Need for more infection prevention
- Prevention of AMR-transmission




The Economist

4th May, 2019, online article

The Review on Antimicrobial Resistance, Chaired by Jim O'Neill (2014)



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# Megatrends: Allergies / autoimmune diseases


‘Hygiene Hypothesis’ = ‘We have become to clean for our own good’


**Scientific consensus today:**

- Reduced microbial exposure and diversity due to western lifestyle
- Regulation of immune response in early life
- ‘Old Friends’ and ‘diversity hypothesis’: microbiome

Source: IFH Report (2012). The hygiene hypothesis and ist implications for home hygiene, lifestyle and public health.

# Megatrends: Microbiome

Health

**Microbiome impacts:**
**-our immune system**
**-weight**
**-mental health**
**-etc.**

## Microbiome is impacted by

- Food
- Mood / stress
- Antibiotics
- Use of cosmetics / deodorants / shower gels / shampoos / washing detergent? / softener?

**-high diversity = healthy microbiome**
**-reduced diversity due to western lifestyle and personal hygiene products (preservatives)**
**-impact of laundry product (fabric softener) unclear**

Picture from Dr. Paul Clayton - The microbiome and the brain

# Conflicting needs and trends in home hygiene

Climate change / pollution / resource scarcity

Demographic / social changes

Health

Home hygiene

# Our home as a hygienically safe place?

The home is an environment where infections are transmissed, a proper home hygiene helps to prevent infection transmission

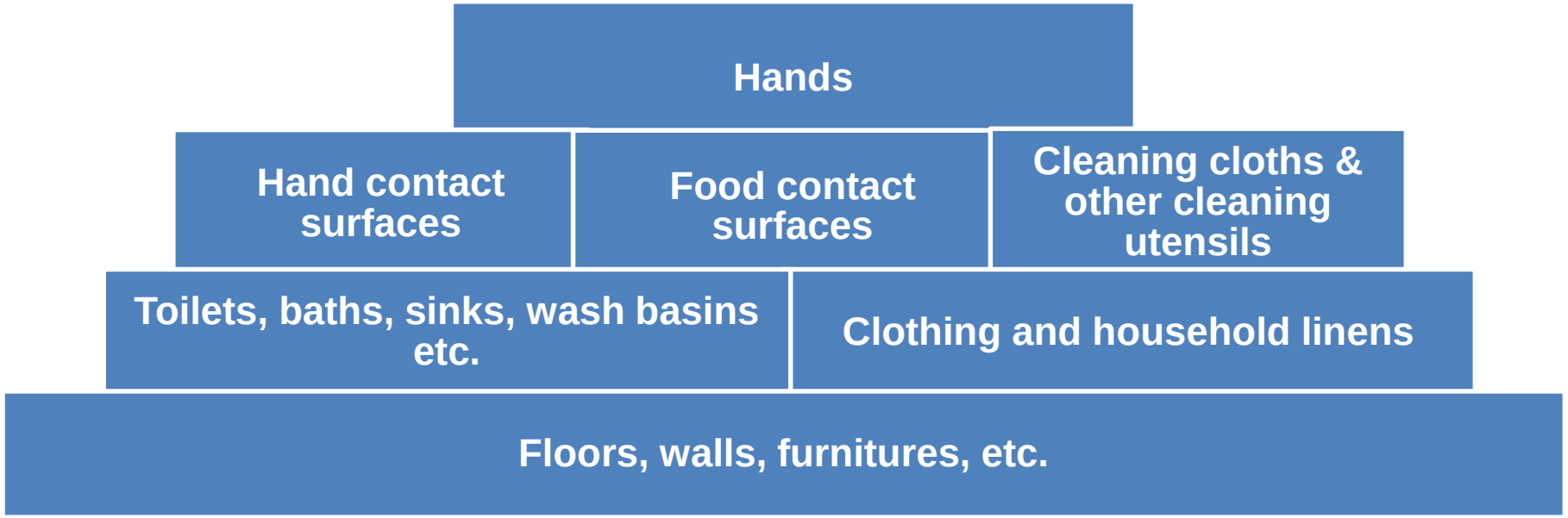
**Dirty public area versus safe and clean homes?**

*Public restrooms are often more hygienic than the kitchen at home*

**Critical places at home**

- Kitchen!
- Surfaces (hand / food contact)
- Cleaning clothes
- bathroom

# Vectors for infection transmission



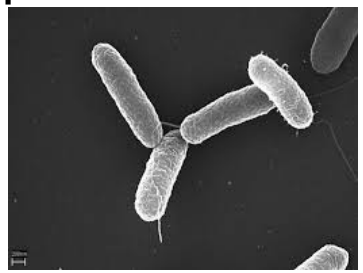

- Respiratory infections (cold, flu): inhalation, hands
- Diarrhoeal diseases: hands, contaminated food or water
- Skin and eye infections: hands

*Source: IFH report (2011).The infection risks associated with clothing and household linens in home and everyday life settings, and the role of laundry*

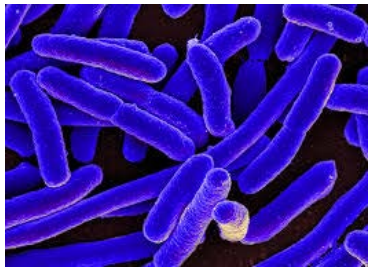
# Food-associated infections

- Food-borne infections are highly prevalent
  - **Norovirus**
  - **Salmonella**
  - **Campylobacter**
  - **Rotavirus**
  - **E. coli**
  - Listeria

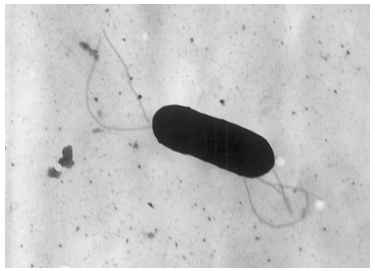
*Campylobacter jejuni (Wikipedia)*



*Salmonella typhimurium (Wikipedia)*



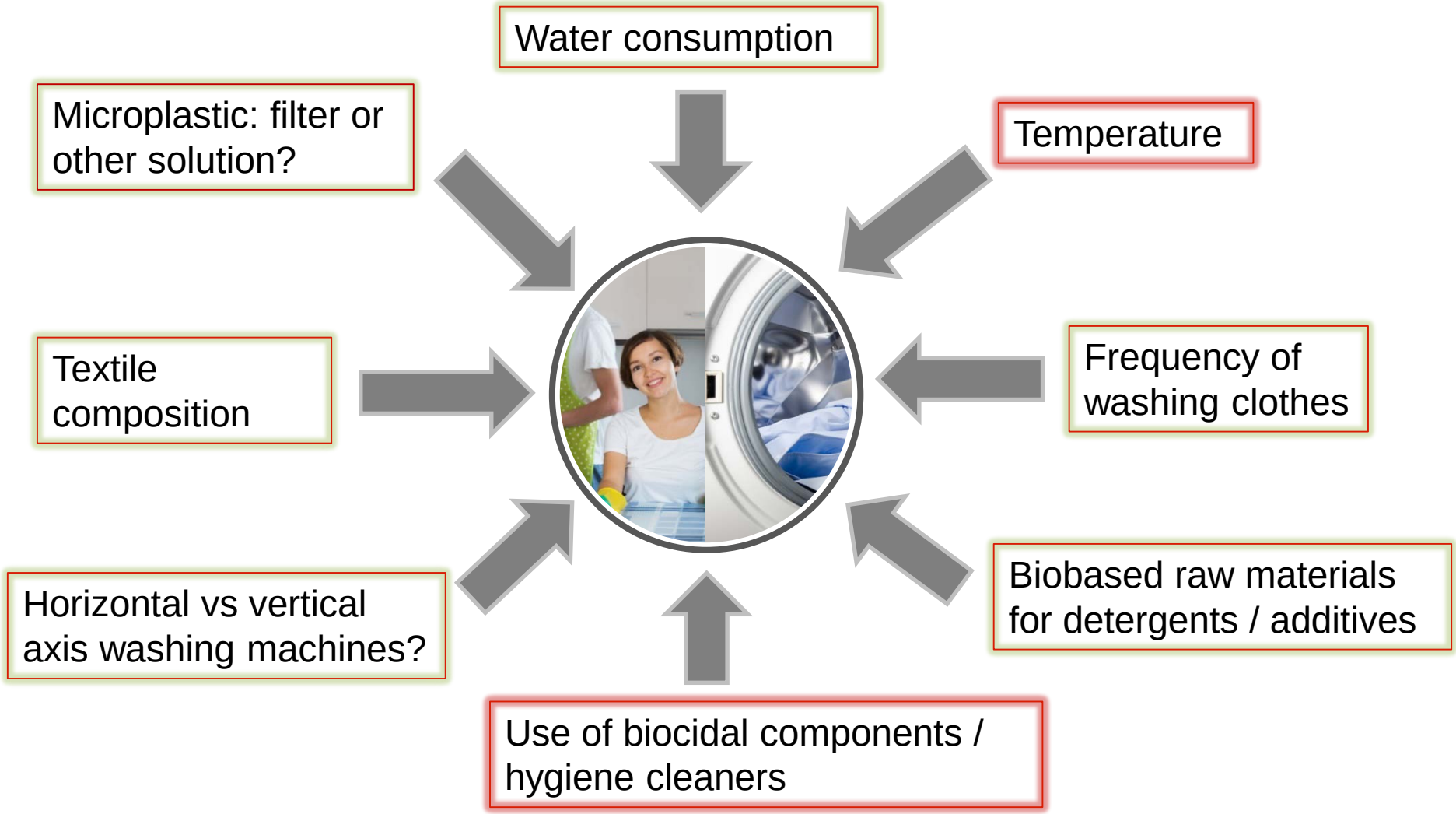
*E. Coli (Wikipedia)*



*Listeria sp.*

- Majority of those infections are acquired at home
- The kitchen as the most critical area in the home

# Laundry hygiene – conflicting needs and trends



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# Washing temperature

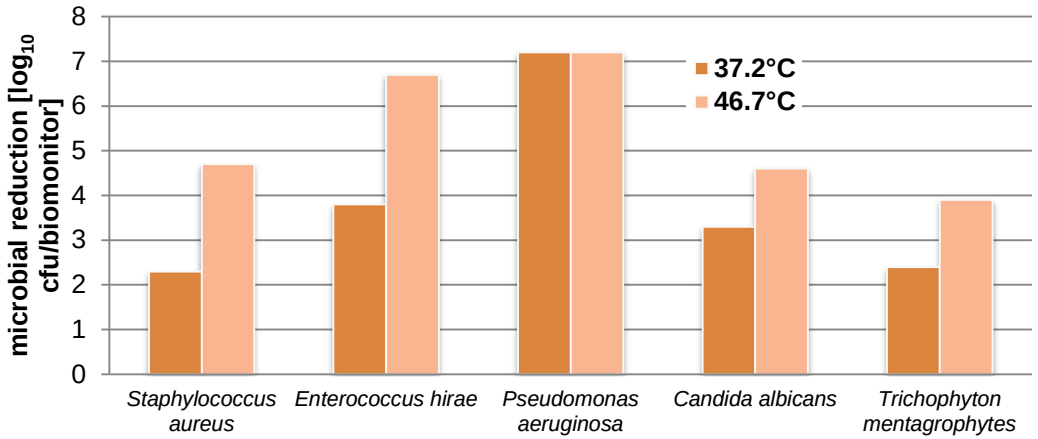
## Energy saving for 10°C less

| | Finnland, Sweden, Norway | Spain, Portugal |
|---|---|---|
| **Average washing temperature** | 45°C | 33-36°C |
| **Energy consumption per cycle [kWh/cycle]** | 0.7 | 0.44-0.5 |

**→ 0.2 to 0.25 kWh savings per cycle**

## Microbial reduction for 10°C less

15 min main wash cycle, detergent without AOB




**→ Significant lower microbial removal**

Gooijer & Stamminger (2016). Tenside Surf. Det., 53 (5), 402-409

Honisch, Stamminger & Bockmuehl (2014). J. Appl. Microbiol., 177, 1787-1797



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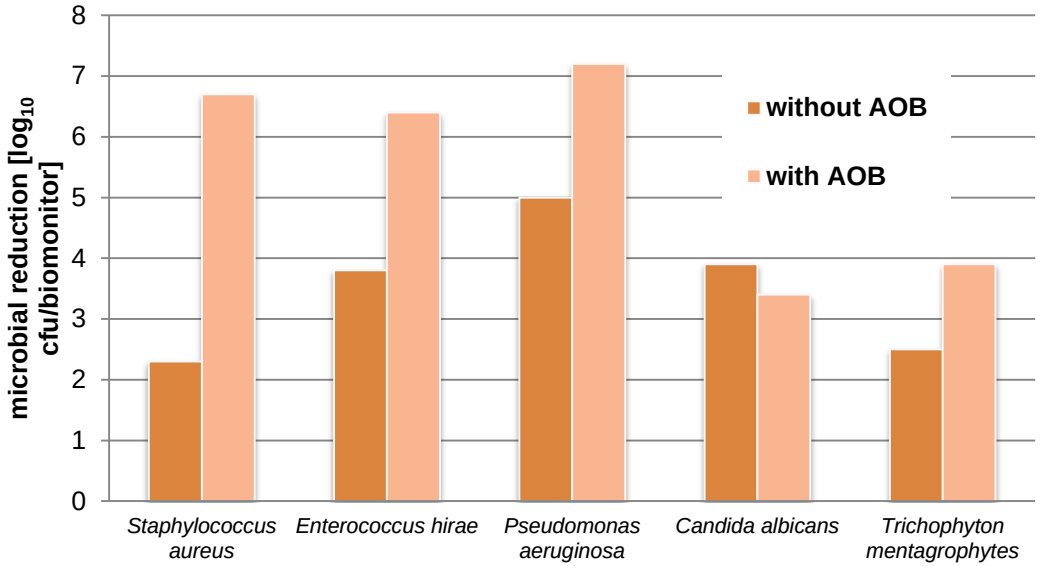
# Washing temperature

## Is washing at 20°C critical?

45 min main wash cycle, detergent without and with AOB




- **Answer: It depends!**
- **Use of detergents with AOB can help to achieve a sufficient microbial reduction even at 20°C**
- **Not true for fungal strains (Dermatophytes as athlete's foot)**

Honisch, Stamminger & Bockmuehl (2014). J. Appl. Microbiol., 177, 1787-1797



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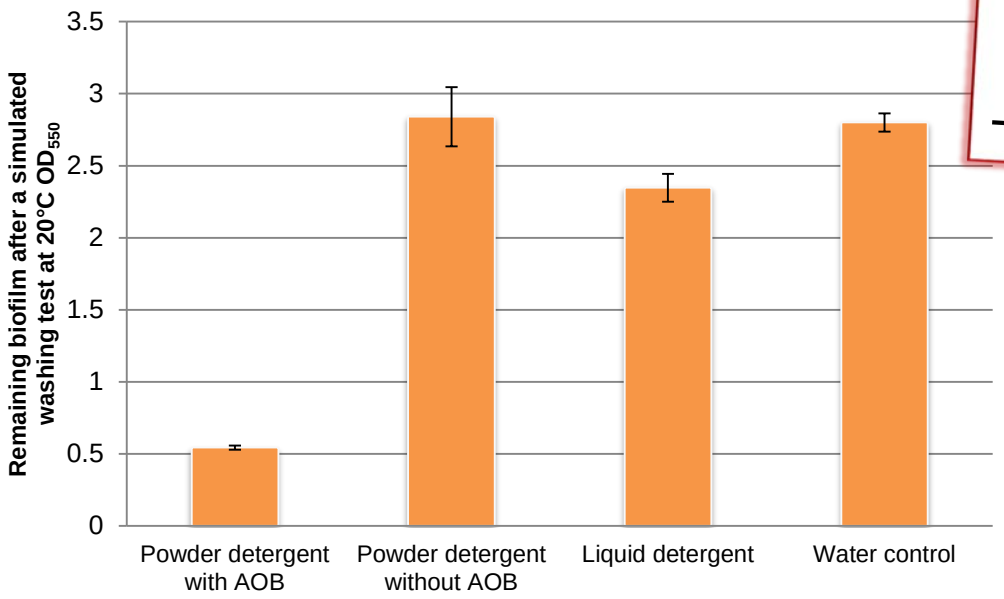
# Washing temperature

## Biofilm and malodor formation?

20°C, simulated washing test, 30 min, main wash, two rinsing cycles




- Use of detergents with AOB can help to delay biofilm and odor formation
- At 20°C total prevention of biofilm and odour formation not possible
- Washing machine cleaning cycles at 60°C with additional biocidal acting products?
- Loss of all saved energy?

Internal investigation Swissatest (2013)



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# Use of biocidal components / laundry cleanser

**Do some active substances induce antimicrobial resistance?**

- Chlorhexidin, Triclosan may promote antimicrobial resistance development (Judkina, Marathe, Flach & Larsson, 2018)
- Metastudies: contradictory results of laboratory and in situ studies

**Health care at home: Special disinfecting laundry product may be needed in certain situations**

- **Are the used disinfectant / biocides safe or do they increase the AMR-problem?**
- **Impact on microbiome?**
- **Further research needed!**


Judkina, Marathe, Flach & Larsson (2018). Science of Total Environment, 616/617, 172-178.
Donaghy et al. (2019): J Food Protection, 82(5), 889-902.



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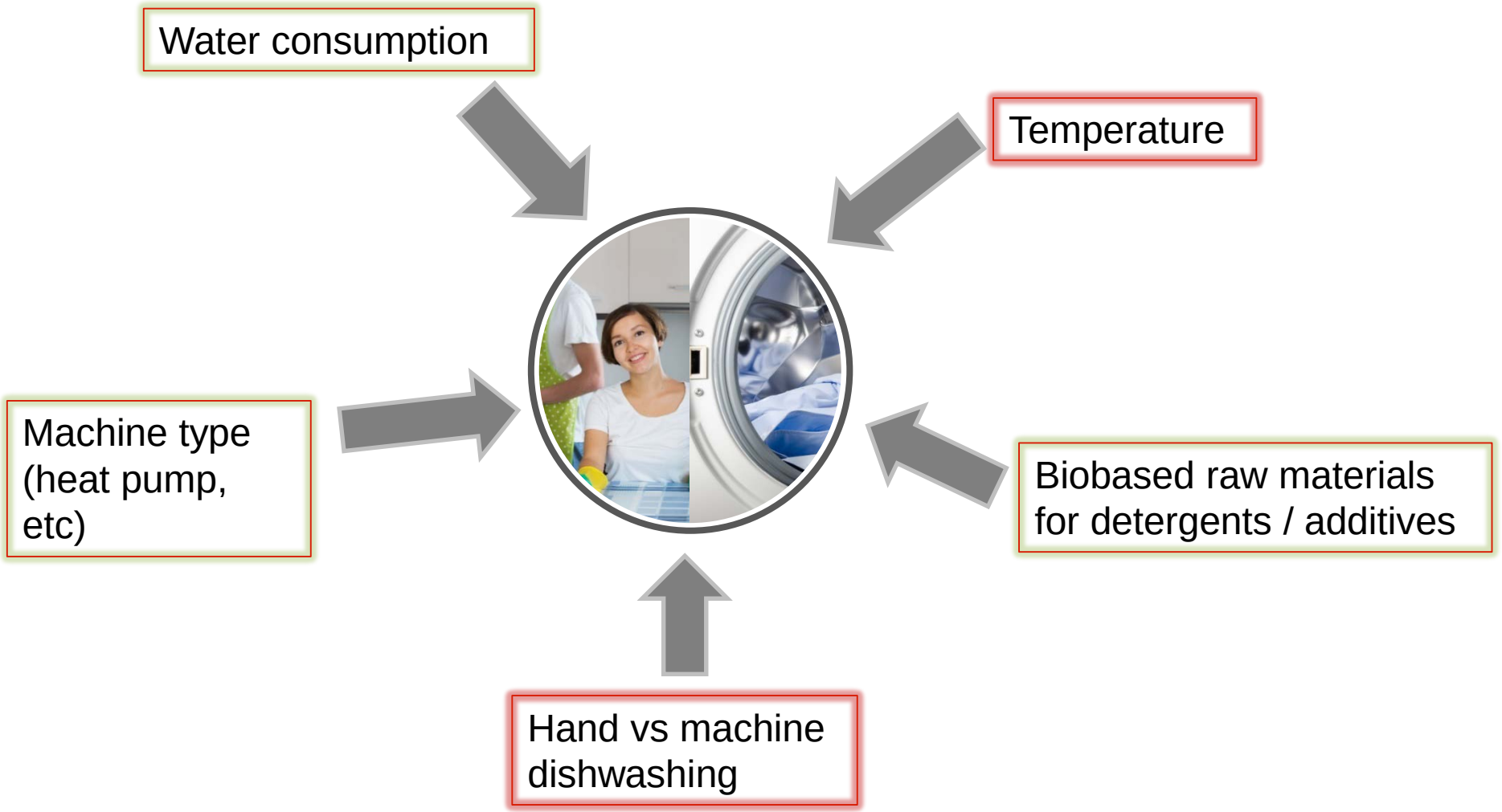
# Dishwashing hygiene – conflicting needs and trends



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# Dishwasher hygiene – critical aspects

- Pathogens are present and circulate in kitchen
- Microbial transfer from dish to food can occur
- Dishwashing helps to break the chain of infection: *dish / cutlery / cutting boards reduced to acceptable level*
- Visible cleanliness alone ≠ safe surface / dish
- Pathogenic fungal strains in the dishwasher (Exophiala)?

**Impact of temperature = major factor**
**-what about <50°C?**

Mattick, K. et al. (2003). Int. J. Food Microbiol., 85, 213-226;
Brands, B., Bockmühl, D. (2015). Tenside Surf. Det. 52, 2, 148-154.;
Stahl-Wernersson, E., Jeppsson, M., Hakanson, H. (2006). Journal of Foodservice, 17 ,111-118

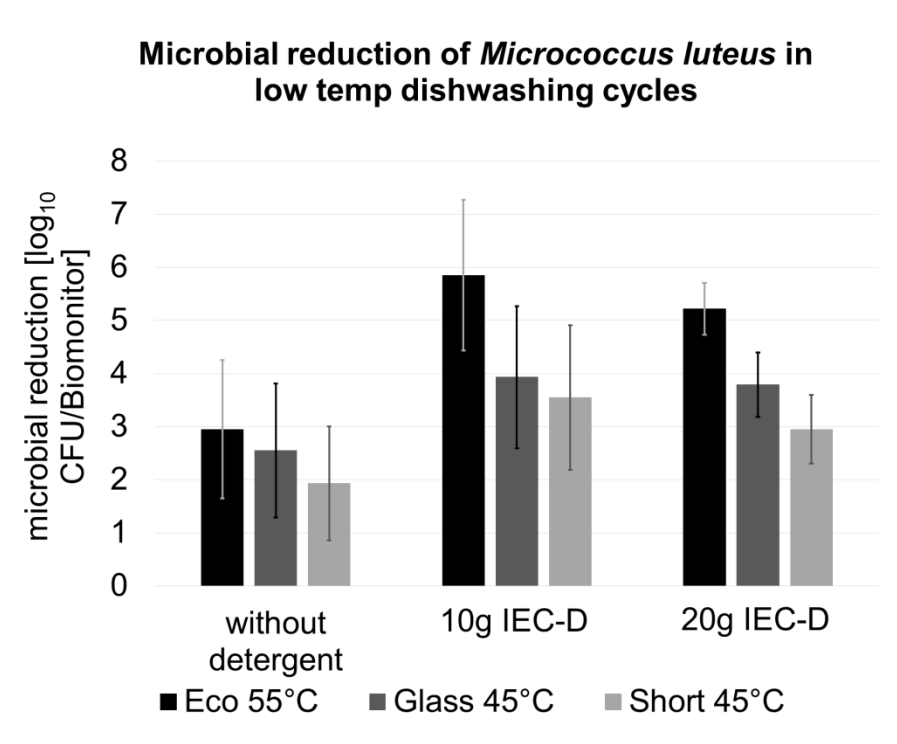
# Hand vs machine dishwashing

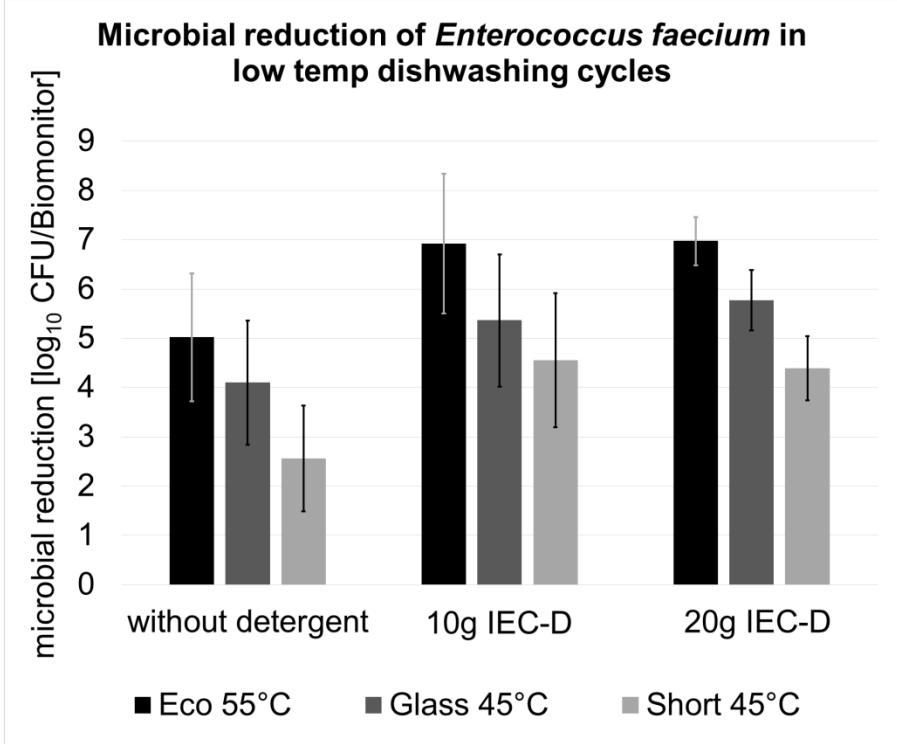
Ihne, S. (2006). ISBN 978-3-8322-5410-0

- In manual dishwashing, no microbial reduction due to  temperature or chemistry
- The highest reduction in automatic dishwashing due to temperature and chemical action

**Machine dishwashing is better from a hygienic AND environmental point of view**

# Dishwashing temperature




**-temperature and AOB-containing detergent = main hygiene contributors**
**-short cycles are more critical**
**-a microbial reduction of > 5 $log_{10}$ steps only achieved in Eco 55°C**

Amberg (2018). Microbial reduction in low temperature dishwashing cycles, Tenside Surfactants Detergents 55 (5), 383-390



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# What can we do to shape the future?

## Build a scientific data base

- Impact of temperature, detergents, time, water consumption, programs etc. on microbial reduction (washing machines / dishwasher)
- Biocide induced antimicrobial resistances (preservative, softener)
- Impact of laundry / personal care products on microbiome
- How can biofilm and odour formation in washing machines / dishwashers  be prevented

## Find technical solutions

- Microplastic
  - Filter or alternative idea
  - Synthetic textiles will be needed in the future and are also ‘sustainable’

**A comprehensive view and joint actions are needed!**

# Distinguish between normal and critical situation

- **Normal situation with healthy family members**
  - Lowest temperature needed from a hygienic point of view
  - powder detergent with bleach for washing / dishwashing
  - Only products that are absolutely needed
  - Wash less, wear longer / full loads
  - Keep your devices in a good state to avoid biofilm and odor formation
  - Don’t use disinfecting products for surface cleaning / hand dishwashing etc.

**Targeted hygiene measures = green + clean**

# Distinguish between normal and critical situation

**Targeted hygiene measures = green + clean**

## Critical situation

- Necessary temperature from a hygienic point of view
- AOB-containing detergents
- Hygiene cleanser for washing
  - Health care at home
  - Gastrointestinal disease of family members
  - Immunocompromised family member
- Disinfecting surface and hand cleanser
- Targeted use of hygiene cleanser!

# Thank you for your attention!