



# **ENVIRONMENTAL CONTAMINATION WITH CYTOTOXIC DRUGS IN EUROPEAN HOSPITALS**

Second MASHA project campaign in collaboration with ESMO  
(European Society for Medical Oncology)

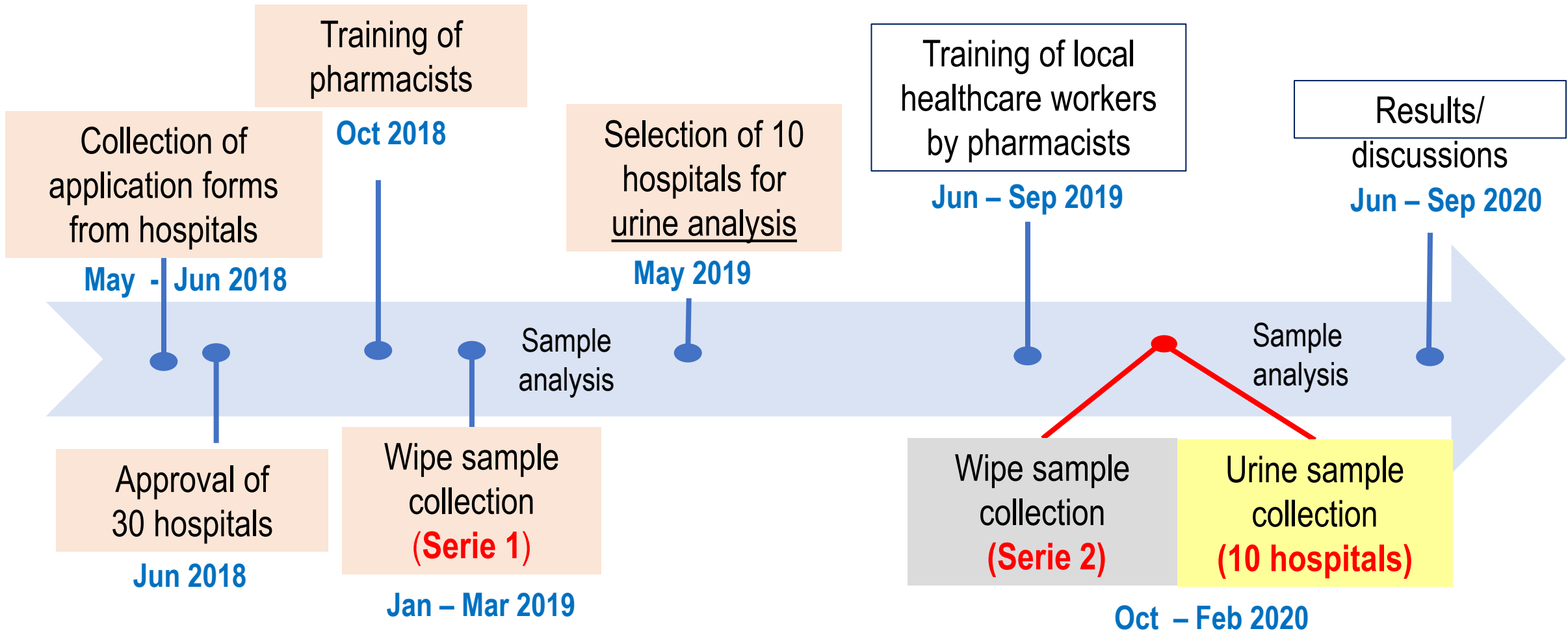
# Background

A number of studies show that antineoplastic drug contamination is found on various work surfaces in hospitals [e.g. Chauchat L et al. 2018, Hon CY et al. 2014]. The results of a pilot study of the actual project (MASHA) showed that environmental contamination with cytotoxic agents still occurs at different levels in different hospitals and varies widely in the wards. It is also shown, that contamination in the pharmacies should not be compared with contamination in the wards . Reasons for these differences are differences in amount of handled preparations, kinds of preparation, number of engaged workers, education, procedures, working time, and workers experience in handling cytotoxic drugs. Therefore the next step of the MASHA project is to set up new research in cooperation with ESMO (European Society for Medical Oncology) for the evaluation of contamination levels only in the wards.

# Study Goals

1. To obtain an **overview of the current levels of cytotoxic contamination** in the workplace in European hospitals
2. To detect potential **body exposure to cytotoxic agents** of ward personnel in the most contaminated hospital wards
3. To **examine the value of providing dedicated tutorials for hospital staff** in the safe handling of cytotoxics in oncology wards as a way of reducing contamination levels
4. To **increase awareness** among healthcare workers and their employers of the risks associated with handling hazardous drugs and to provide them with measures for protecting their health

# Design of the Project



# Hospitals in the Project

- **28 hospital units** from **16 European countries**
- Different types of hospitals:
  - *General, University, Children, Oncology*
- Differences in amounts of preparations
  - *4 – 60,000 preparations per year*
- Differences in established local procedures
  - *32% (9/28) hospitals have not established procedures on the ward*



# Materials and Methods



S  
A  
M  
P  
L  
E

Cyclophosphamide  
5 - Fluorouracil  
Gemcitabine  
Paclitaxel  
Total Platinum



**Top of work  
benches**  
*in the nurse's room*

**Floors**  
*in the nurse's room*

**Armrest**  
*of patient's chairs*

**Lids of cytotoxic  
waste containers**



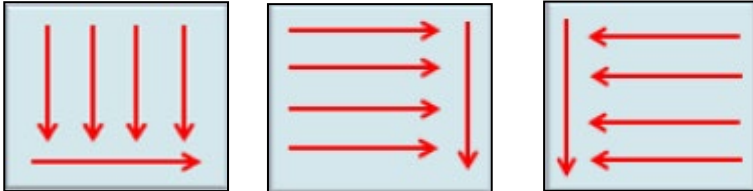
# Materials and Methods

Wipe samples were collected:

- by a representative pharmacist in each hospital
- according to an established procedure using three tissues applied with special solvent adapted for this purpose

**Analytical method:** LC-MS/MS and ICP-MS for total platinum

**Laboratory:** The Institute of Energy and Environmental Technology (IUTA)  
Duisburg, Germany



Tuerk J et al. *Int J Environ Anal Chem* **2011**, 91: 1178 - 1190



# Evaluation of Results

**Reference value for all substances**

**0.1 ng/cm<sup>2</sup>**

The contamination levels were graded:

<b>LOW</b>	<b>LOQ* &lt; 0.1 ng/cm<sup>2</sup></b>
<b>MEDIUM LOW</b>	<b>&gt; 0.1 ng/cm<sup>2</sup> &lt; 1 ng/cm<sup>2</sup></b>
<b>MEDIUM HIGH</b>	<b>&gt; 1 ng/cm<sup>2</sup> &lt; 10 ng/cm<sup>2</sup></b>
<b>HIGH</b>	<b>&gt; 10 ng/cm<sup>2</sup></b>

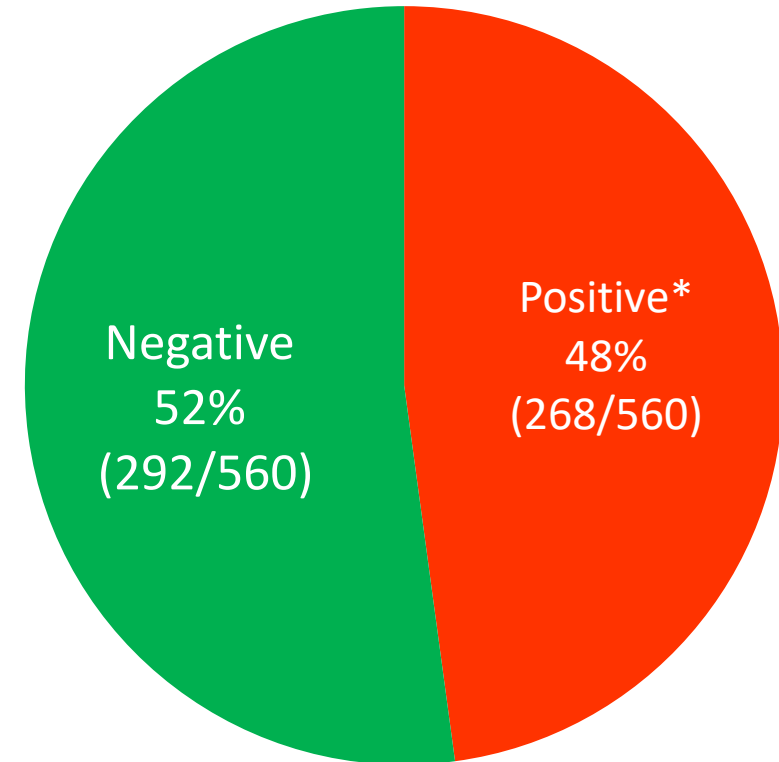
*\*LOQ – Limit of Quantitation*



# Overview of Results

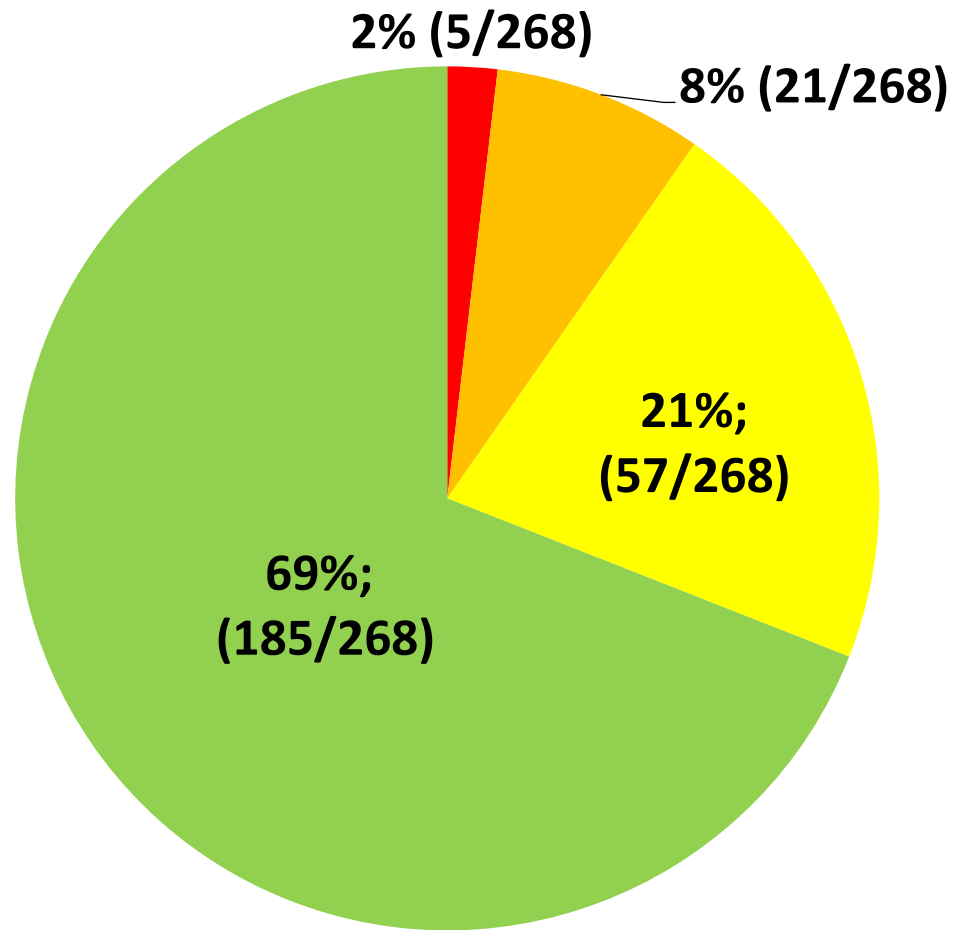
**Serie 1:** 560 results were obtained

In each hospital at least one  
substance was detected  
on the investigated surfaces



\*Positive result means result above the limit of quantification (LOQ)

# Positive results in Grade



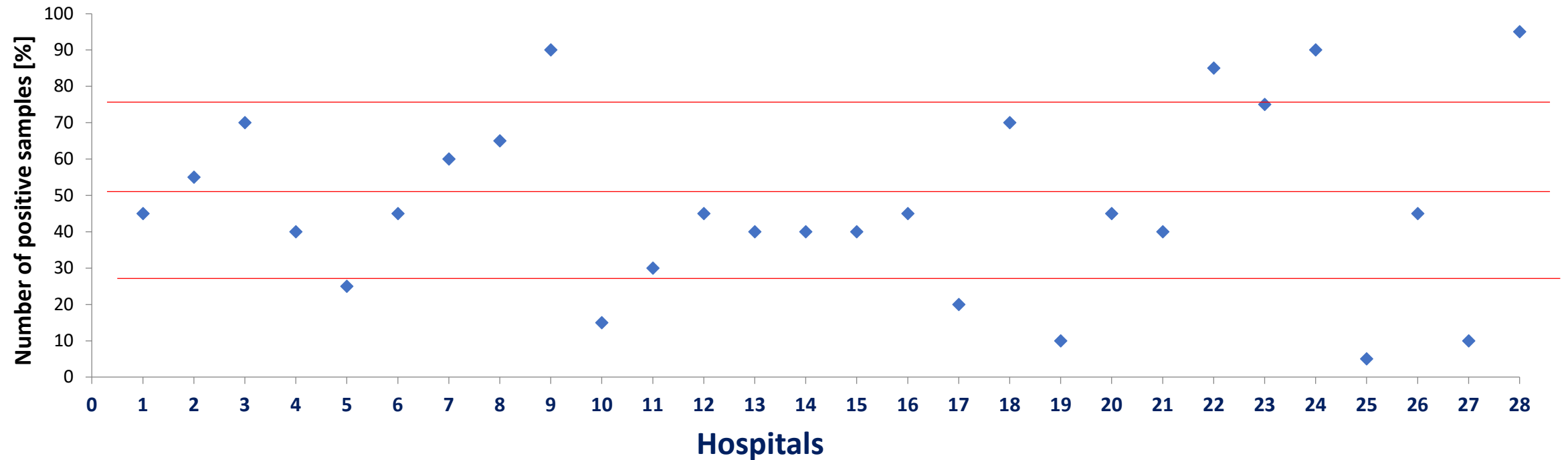
■  $\geq 10 \text{ ng/cm}^2$

■  $\geq 1 \text{ ng/cm}^2 < 10 \text{ ng/cm}^2$

■  $> 0.1 \text{ ng/cm}^2 < 1 \text{ ng/cm}^2$

■  $\text{LOQ} \leq 0.1 \text{ ng/cm}^2$

# Overview of Results



**21/28 Hospitals had over 30% of positive samples**



# Results - surfaces

## Number of positive samples in total (%)

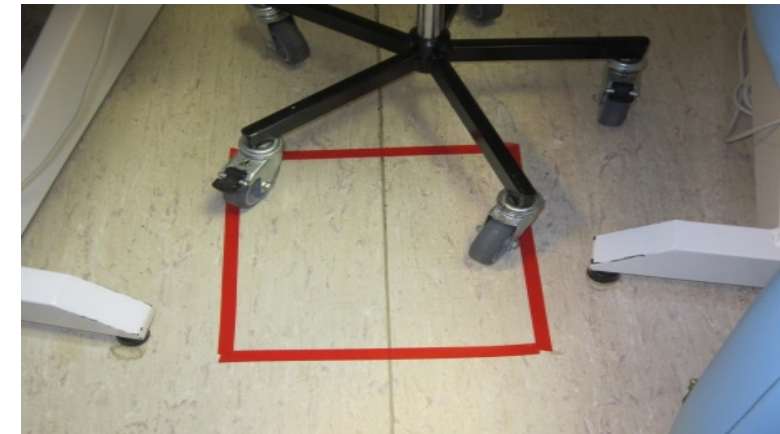


# Overview of Results

## The highest amount of contamination



**380 ng/cm<sup>2</sup>** (*cyclophosphamide*)  
**130 ng/cm<sup>2</sup>** (*5 – fluorouracil*)  
**18 ng/cm<sup>2</sup>** (*gemcytabine*)

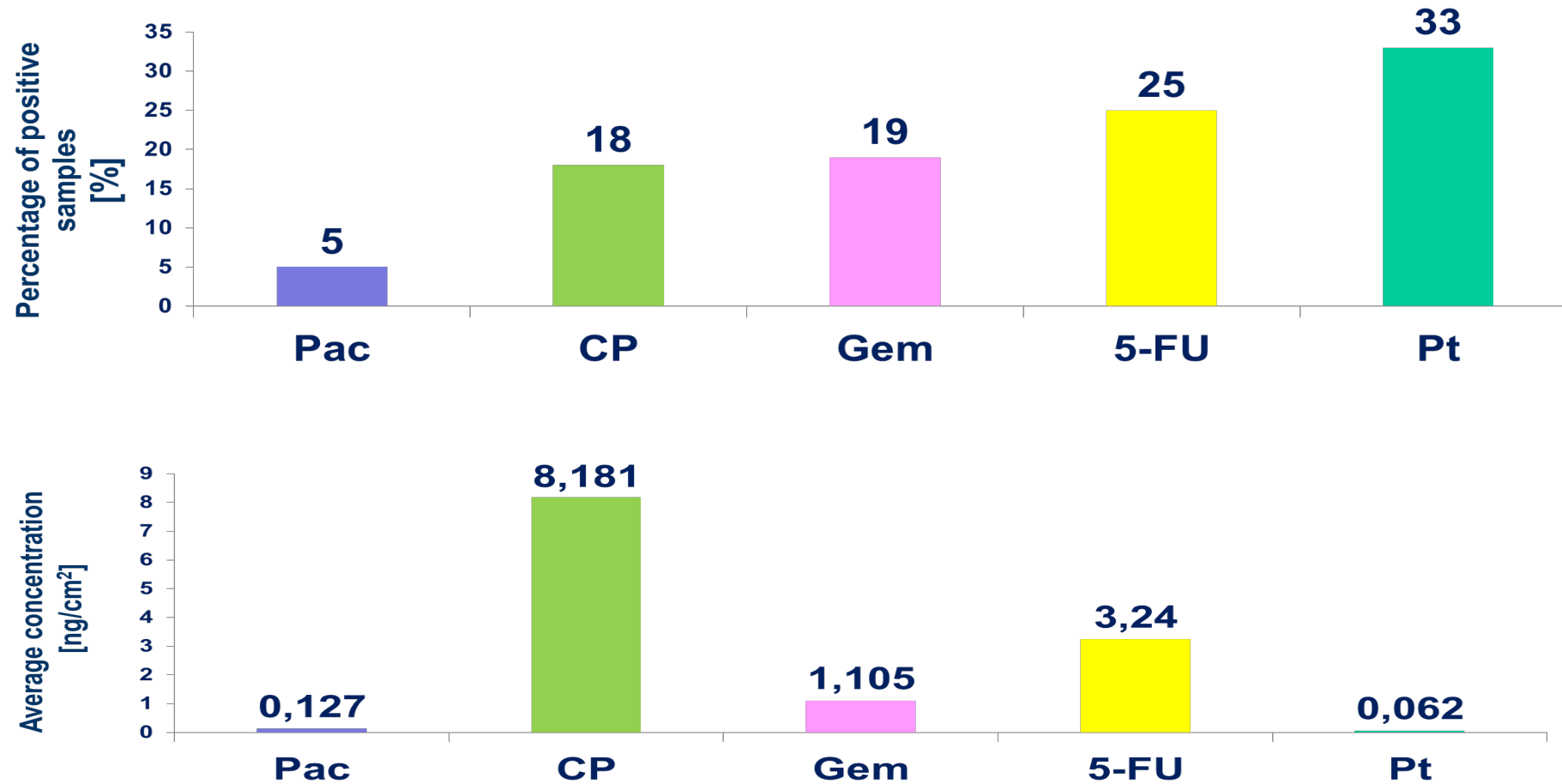


**31 ng/cm<sup>2</sup>** (*gemcytabine*)  
**16 ng/cm<sup>2</sup>** (*5 – fluorouracil*)

**Reference value for all substances**

**0.1 ng/cm<sup>2</sup>**

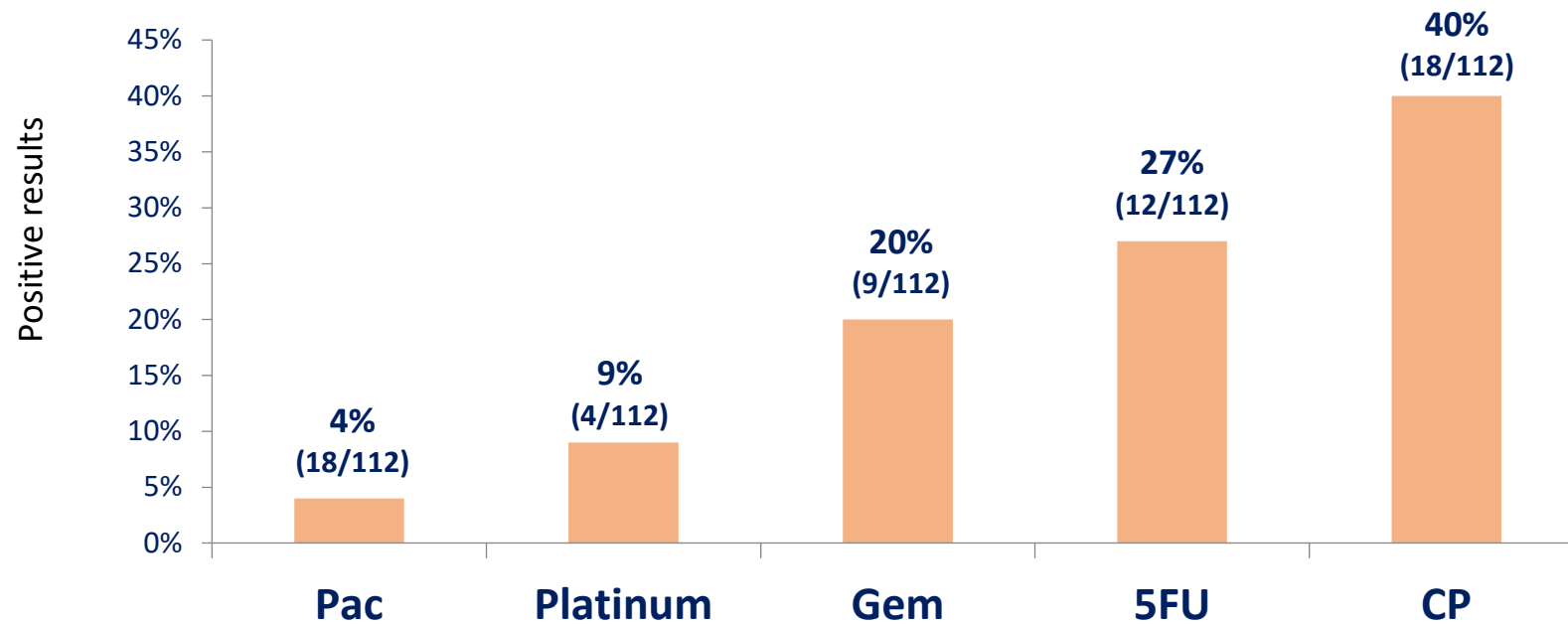
# Results - substances





# Results - substances

On 40% (45/112) of surfaces, substances were detected which were **NOT** administered in the wipe sampling day



## 5FU

130 ng/cm<sup>2</sup> – Lid

7,5 ng/cm<sup>2</sup> – Floor

6,0 ng/cm<sup>2</sup> – Floor

4,1 ng/cm<sup>2</sup> – Armrest

3,1 ng/cm<sup>2</sup> – Table

Reference value for all substances **0.1 ng/cm<sup>2</sup>**

Second MASHA project campaign in collaboration with ESMO (*European Society for Medical Oncology*)

- Evaluate surface contamination with cytotoxics on wards
- Measure body exposure to cytotoxic agents of ward personnel working in the most contaminated hospitals

**SERIE 1**

Jan - May 2019

- 560 results (28 ward units)
- 48% positive results
- at least 1 substance detected in each hospital
- Floors>Armrest>Lids>Tablets

- **28 hospitals** from **16 European countries**
- **Time: May 2018 – March 2020**
- **Assessment of surface contamination and body exposure**
  - **Surface: CP, 5-FU, Gem, Pac, Pt**
  - **Urine: CP, Gem** (only in Serie 2)
- **IUTA Lab, Duisburg, Germany**

**SERIE 2**

Oct 2019 - March 2020

- 520 results (26 ward units)
- 32 urine samples from:
  - Doctors (11)
  - Nurses (15)
  - Cleaning stuff (5)
  - Pharmacist (1)

Implementation of ESOP cleaning recommendations  
Training of local healthcare workers on wards (doctors, nurses, cleaning personnel)

**NEXT STEPS**

- Statistic evaluation of the results
- Presentation of the final results at ESMO Congress and ECOP5
- Publication of results
- Increase awareness
- Develop additional steps and programs to improve working conditions and quality control procedures