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Decreased susceptibility to didecyldimethylammonium chloride among clinical strains of *Pseudomonas aeruginosa*, a ten years retrospective study, at the University Hospital of Caen, France.

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INTRODUCTION

- **Didecyldimethylammonium chloride (DDAC)** is a quaternary ammonium compound (QACs) used in several **disinfection process** in **hospital** and in **veterinary environments**.
- Throughout 2018, numerous strains of *Pseudomonas aeruginosa* (PSAE) isolated in the University Hospital (UH) of Caen showed a **decreased susceptibility to DDAC**, according to the **NF EN-13727+A2 guidelines** (1).
- **Mechanisms** involved are **not fully understood**, but first studies suggested the **involvement of the resistance-nodulation-division efflux pump MexAB-OprM** (2).
- Decreased susceptibility to disinfectant agents is a **major concern to public health** as it allows pathogens to **persist in their environment**.

AIM

To assess the emergence of DDAC decreased susceptibility among clinical strains of PSAE isolated in a French UH over the last decade.

METHOD

Over the period 2011 – 2020 :

Random inclusion of **10 strains / years** of clinical PSAE strains (100 in total) from the microbiology department of the UH of Caen.

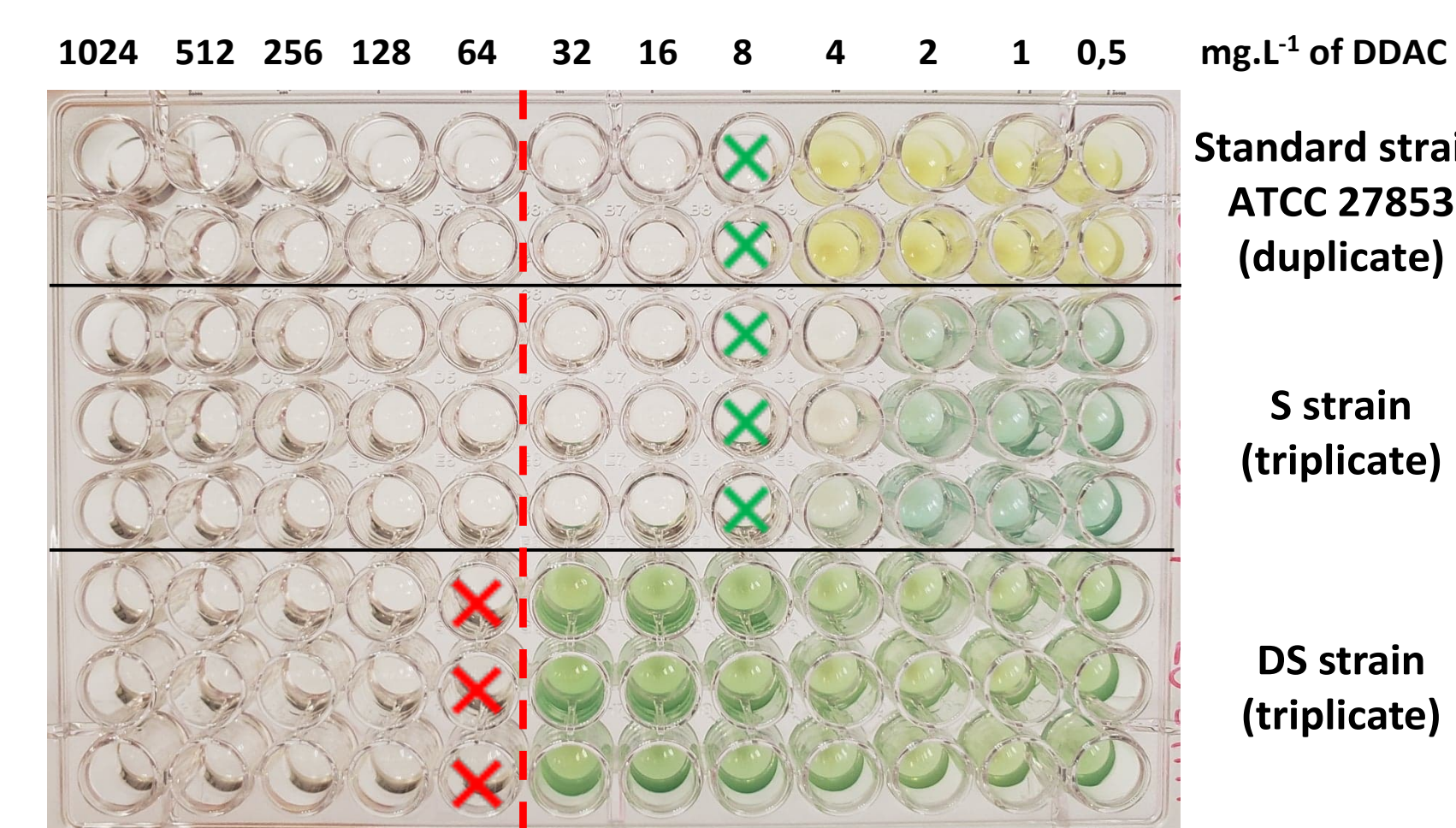
Determination of **Minimum inhibitory concentrations (MICs)**, in triplicate by broth dilution method.

According to the **International Organization for Standardization (3)**.

Decrease susceptibility cutoff corresponding to the **concentration of DDAC in a disinfectant solution** in regard of the **manufacturer's instructions**.

MIC < 62.9 mg.L⁻¹
Susceptible strain (S)

MIC > 62.9 mg.L⁻¹
Decrease susceptible strain (DS)



Determination of MICs to DDAC on microplate.

RESULTS

Table I: Repartition of strains origins.

Isolation year	Strain origin					
	Respiratory	Urinary	Blood culture/Catheter	Digestive	Surgical pus	Others ^a
2011	1	1	4	-	2	2
2012	2	-	6	-	2	-
2013	3	1	2	2	1	1
2014	2	4	-	1	2	1
2015	2	3	2	-	2	1
2016	2	3	-	4	1	-
2017	2	6	-	-	-	2
2018	6	1	-	3	-	-
2019	3	-	-	2	2	3
2020	2	2	1	2	1	2
Total	25	21	15	14	13	12

Notes

^a The following sample types were categorized as "Others": biopsy, ocular, auricular, genital, wound and unknown origin.

Among the 100 strains, the three main origins were (Table I):

- 1) **respiratory** samples → 25 strains
- 2) **urinary** samples → 21 strains
- 3) **blood culture or catheter** samples → 15 strains

CONCLUSIONS

1. The decreased susceptibility to DDAC is **not a new phenomenon** but steady over time and still present.
2. As **nearly one-third** of the tested strains have a decreased sensitivity to CDMA, this could explain, in part, why PSAE is a **persistent bacteria in hospital**.
3. Studies are ongoing to 1) Test PSAE strains isolated from **hospital environment** samples and from **animals** 2) Explore the **mechanism(s) involved** in DS to DDAC.

- For each year (Figure I) and each type of sample tested (Figure II) at least one DS strain was found.
- Overall, **28 of all the tested strains** presented a DS to DDAC.
- MIC range for DS strains was : **64 mg.L⁻¹ or 128 mg.L⁻¹**.

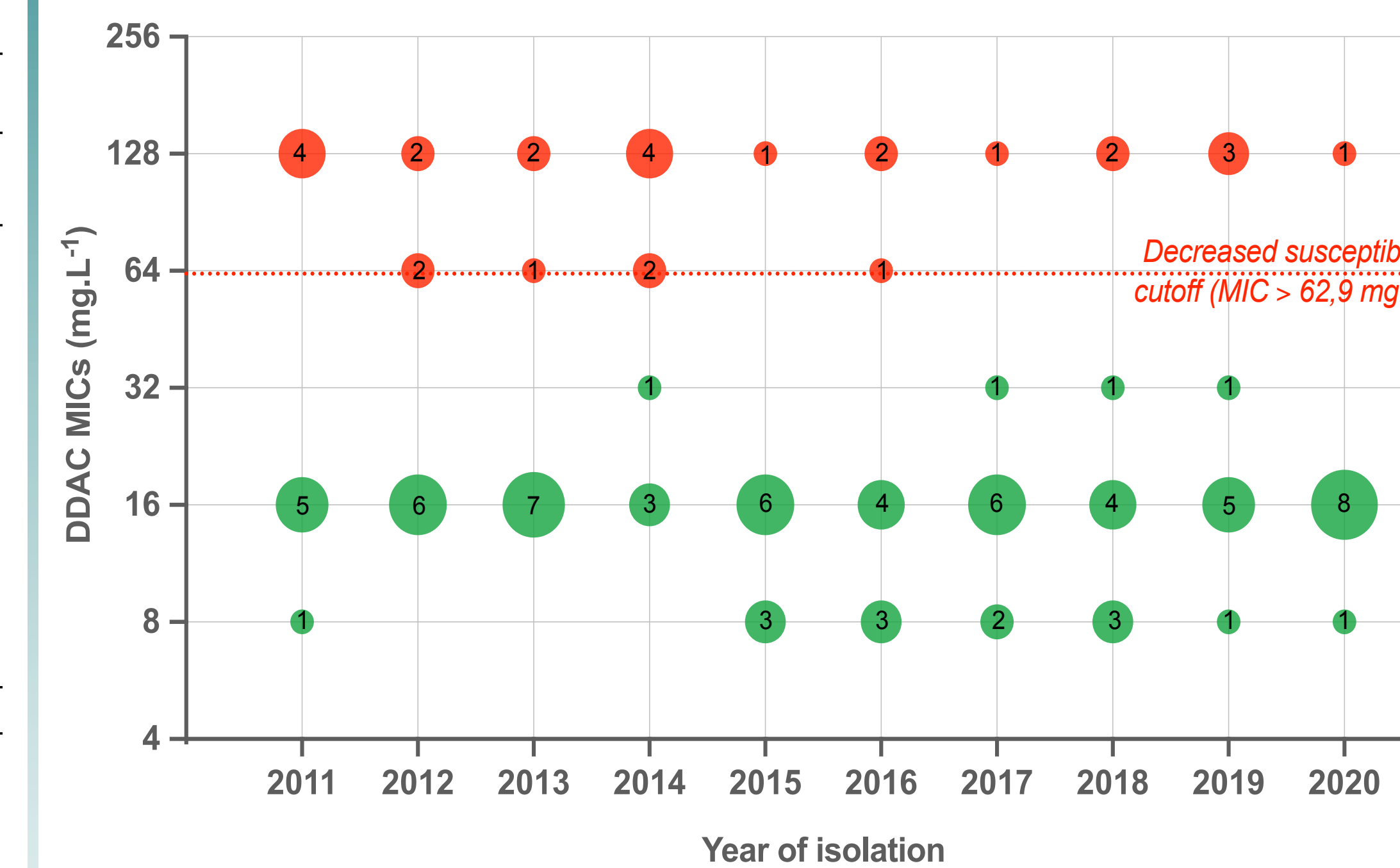


Figure I: Temporal evolution of MICs to DDAC for PSAE strains isolated from patients (n=100). Red dot: strains with DDAC decreased susceptibility; green dot: DDAC susceptible strains; dot size: headcount.

- The annual average rate of DS to DDAC was **28 % (Figure I)**.
- This annual rate varied:
 - from 10 % for years 2015, 2017 and 2020,
 - to 60 % for 2014.
- **No significant variation** of MICs **between and throughout years** (Kruskal-Wallis test, *p*-value > 0,1).

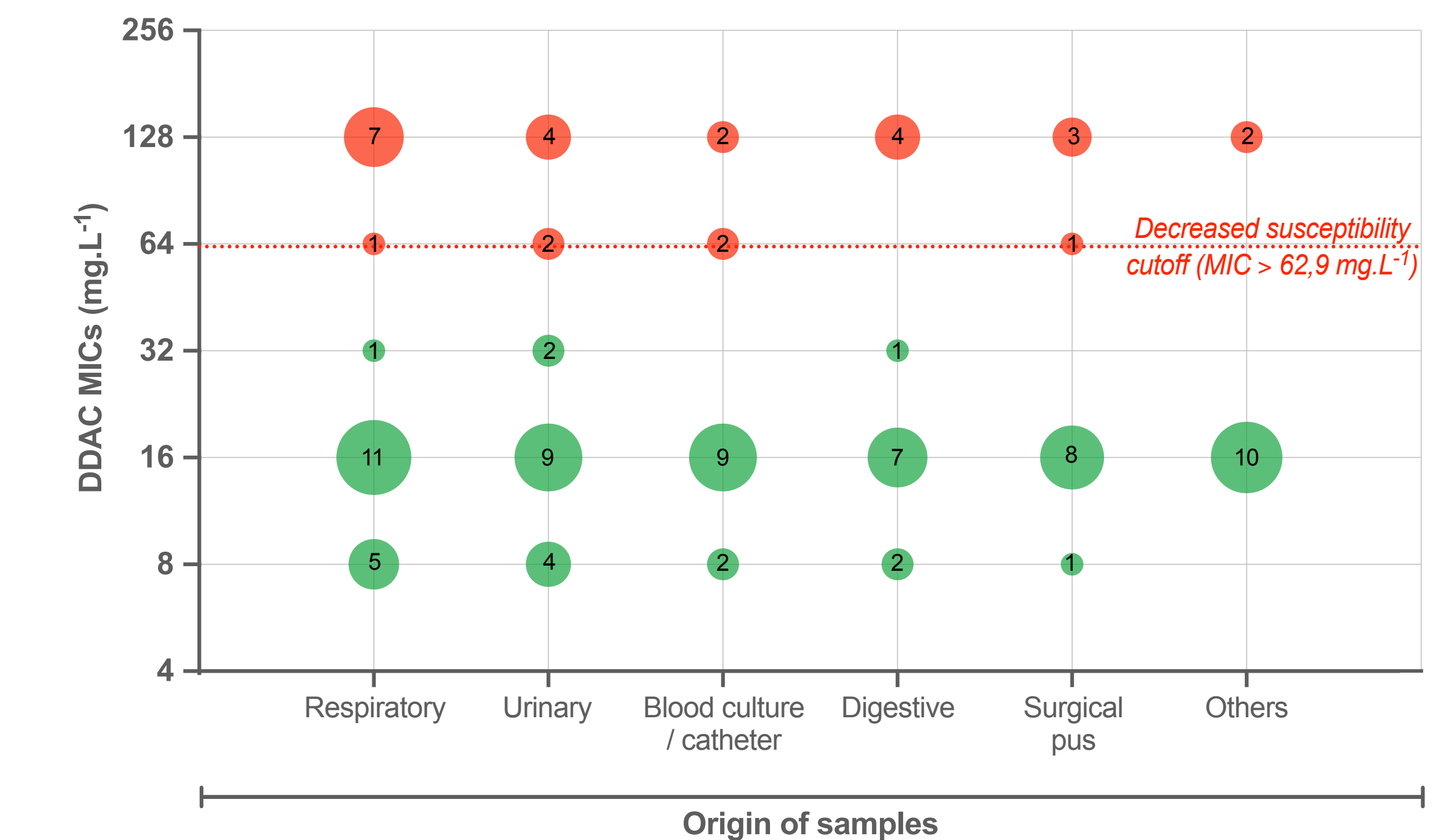


Figure II: Dispersion of MICs to DDAC according to strains origin (n=100). Red: strains with DDAC decreased susceptibility; green: DDAC susceptible strains; dot size: headcount.

- For a given **sample type**, the average rate of DS to DDAC was **27 % (Figure II)**.
- DS to DDAC was the mainly found in:
 - 1) **respiratory** samples (n= 8/25 → **32 %**),
 - 2) **surgical pus** samples (n= 4/13 → **31 %**),
 - 3) **urinary** samples (n= 6/21 → **29 %**) and **digestive** samples (n= 4/14 → **29 %**).

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