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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.

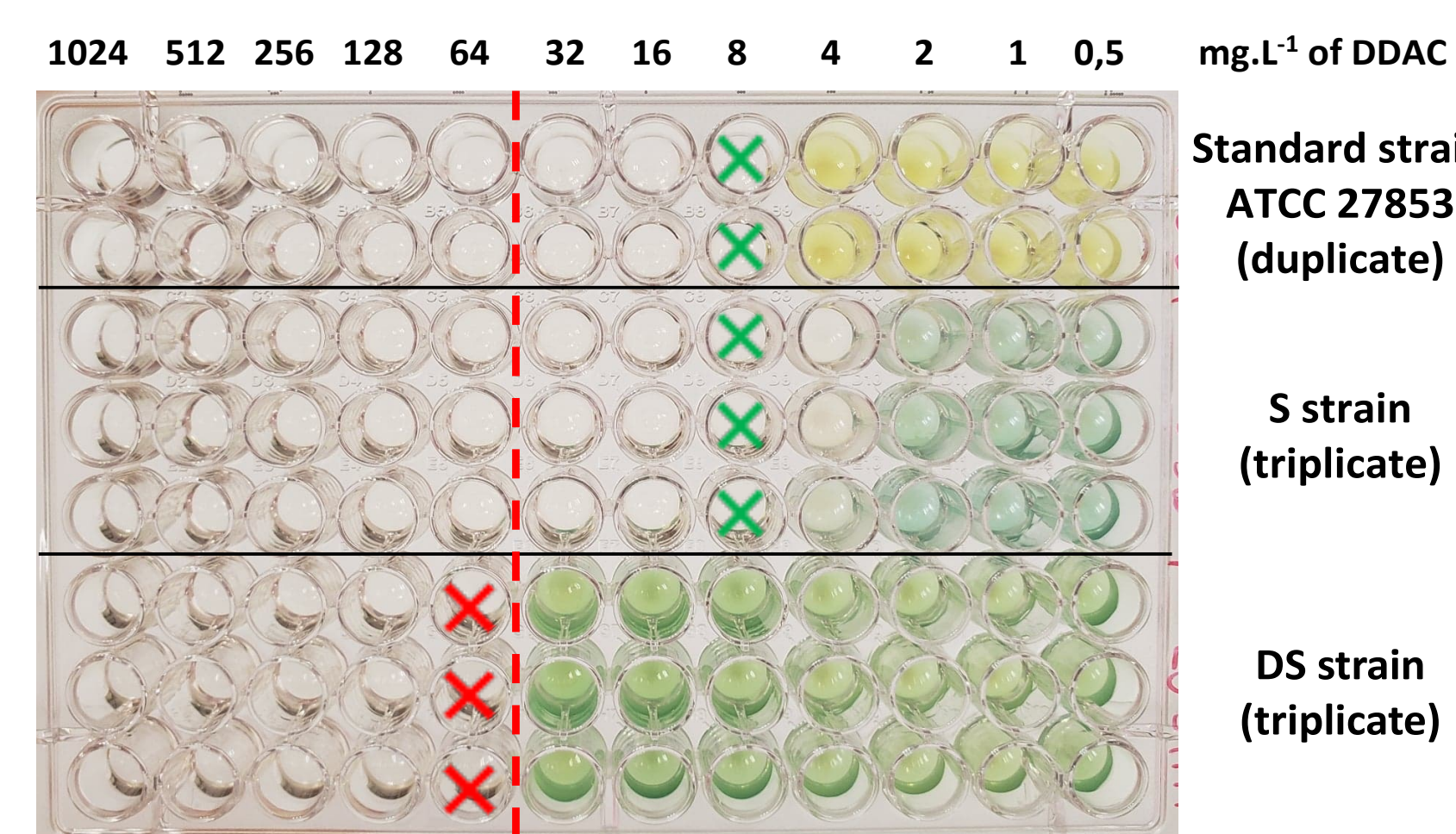
Determination of Minimum inhibitory concentrations (MICs), in triplicate by broth dilution method.

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<sup>-1</sup>  
Susceptible strain (S)

MIC > 62.9 mg.L<sup>-1</sup>  
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 <sup>a</sup> |
| 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

<sup>a</sup> 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<sup>-1</sup> or 128 mg.L<sup>-1</sup>**.

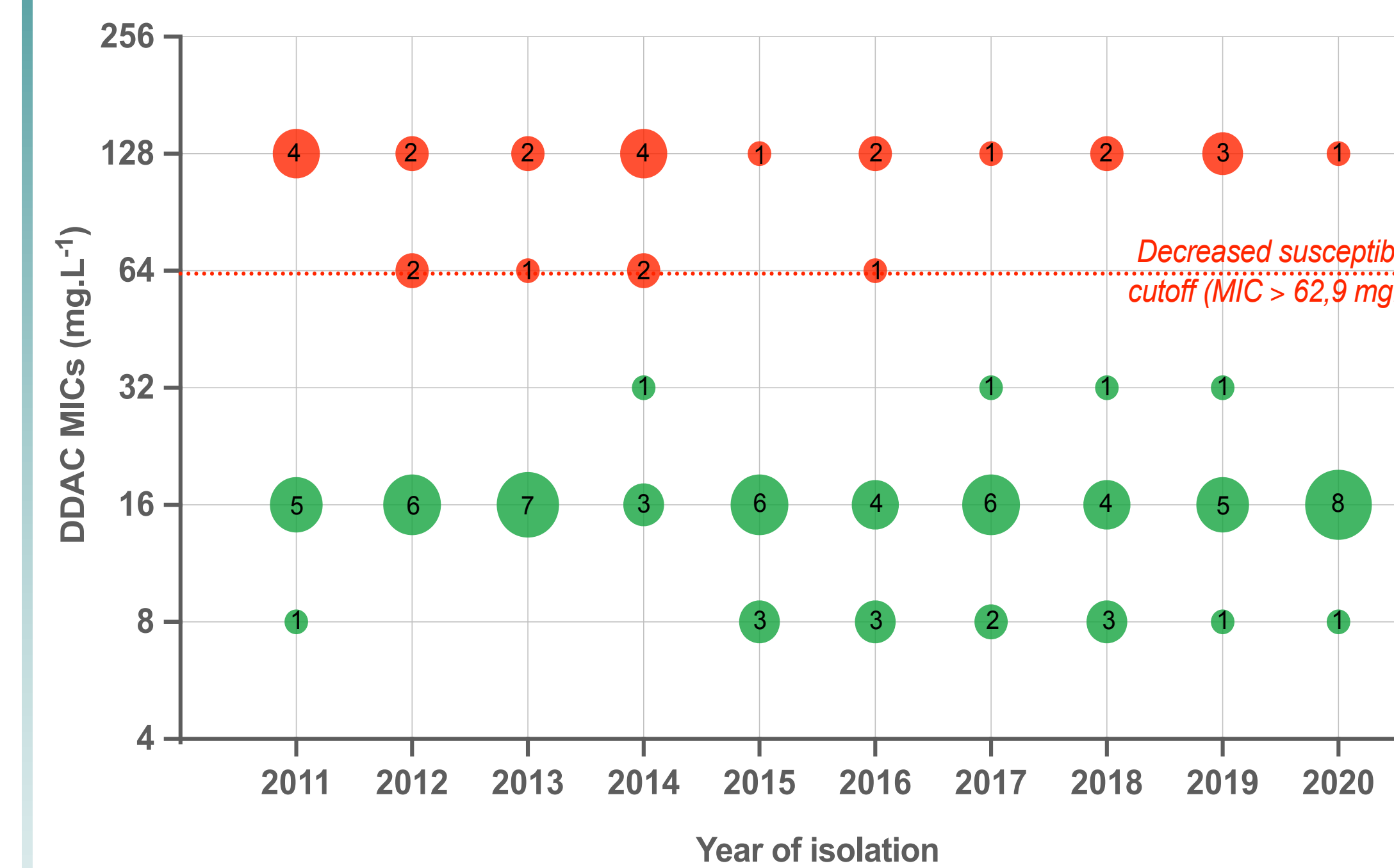


Figure I: Temporal evolution of MICs to DDAC for PSAE strains isolated from patients (n=100). Red dot: strains with DDAC decreased susceptibility; green dot: DDAC susceptible strains; dot size: headcount.

- 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).

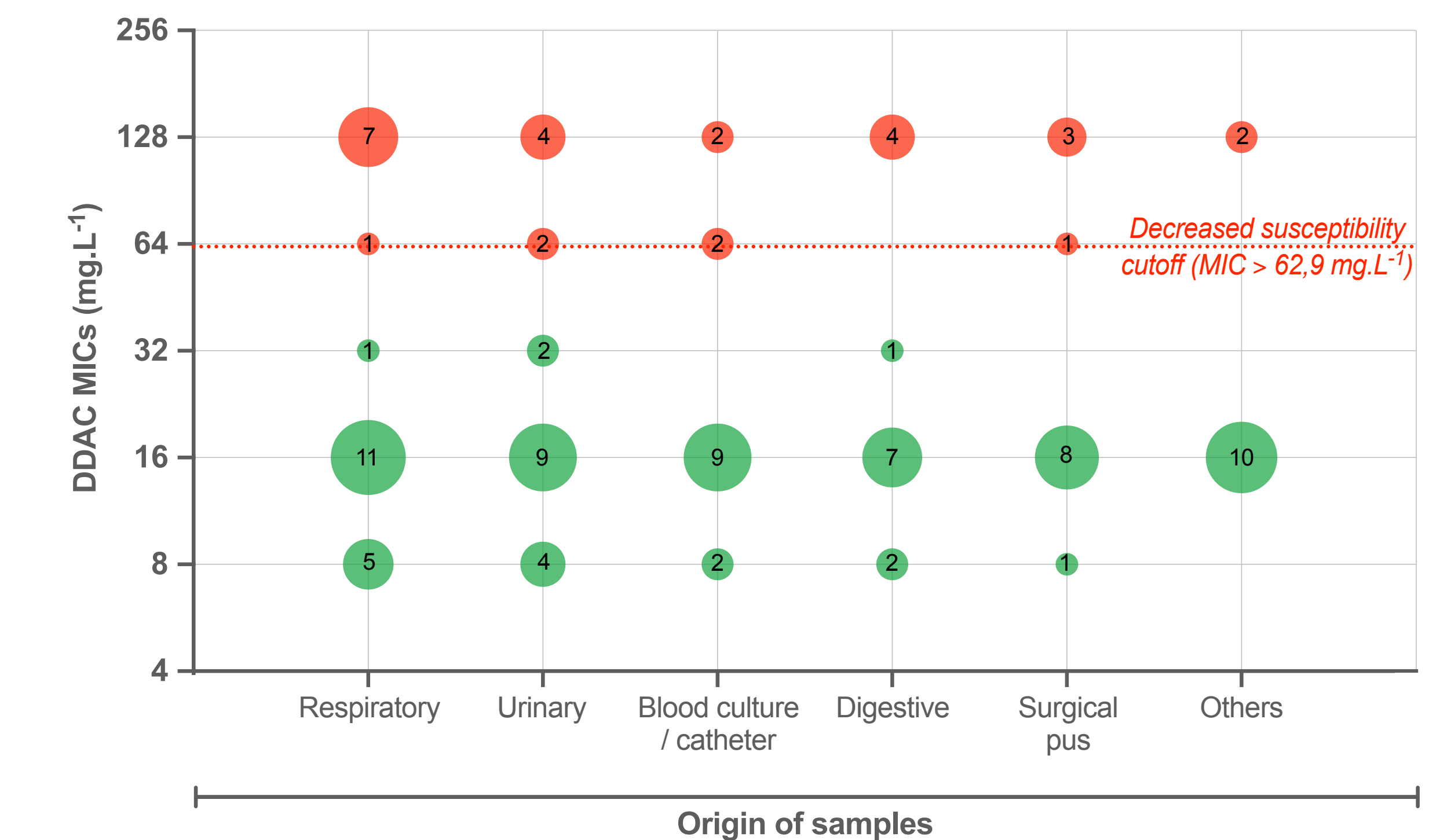


Figure II: Dispersion of MICs to DDAC according to strains origin (n=100). Red: strains with DDAC decreased susceptibility; green: DDAC susceptible strains; dot size: headcount.

- 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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## ACKNOWLEDGEMENTS



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