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☑ Je n'ai pas de lien d'intérêt potentiel à déclarer

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Correlation between antibiotic resistance in *Pseudomonas æruginosa* and antibiotic consumption in an intensive care burn department in Tunisia

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Background

- ***Pseudomonas æruginosa*** : one of the major infection agents in **burn patients +++**

- **Multidrug-resistant (MDR) strains** are sharply increasing **+++** ➔Increases morbidity and mortality rates.

- **Consumption of antibiotics** remains the major determinant of this phenomenon.

- The World Health Organisation (WHO) recommends more rational use of antibiotics and regular monitoring of their consumption

Aim

- To study the correlation between antibiotic resistance in *P. æruginosa* and the consumption of antipseudomonal drugs used in the Trauma and Burn Center's Burn Unit (TBC-BU) in Tunisia

Materials & Methods

- Retrospective study : **6 years (January 2014 – December 2019)**
- **It was divided into 3 parts:**
  1. Description of antibiotic susceptibility in *P. aeruginosa*
  2. Description of antipseudomonal drugs consumption
  3. Analysis of the correlation between **antibiotic resistance** and **antibiotic consumption**

1) Microbiobiological study : Antibiotic susceptibility was determined by the disk diffusion method in accordance with the EUCAST-CASFM guidelines.

2) Antipseudomonal drugs consumption :

- As recommended by the World Health Organisation (WHO), the annual **antibacterial use densities (AUD)** from 2014 to 2019 were calculated and expressed by :

➔ **defined daily doses/1000 patient-days (DDDs/1000 PD)**

$$AUD = \frac{\text{Amount consumed in grams} \times 1000}{\text{DDD} \times \text{PD}}$$

- The Defined Daily Doses (DDD) used in this study were those proposed by the WHO in 2019

3) Data analysis :

- Changes in resistance rates and AUD over the study period were evaluated by the Spearman correlation coefficient (rs).
- The relationship between antibiotic consumption and antibiotic resistance rates was described by Pearson's correlation coefficient (R).
- The significance threshold (p) has been set at 0.05 for all statistical tests.

Results

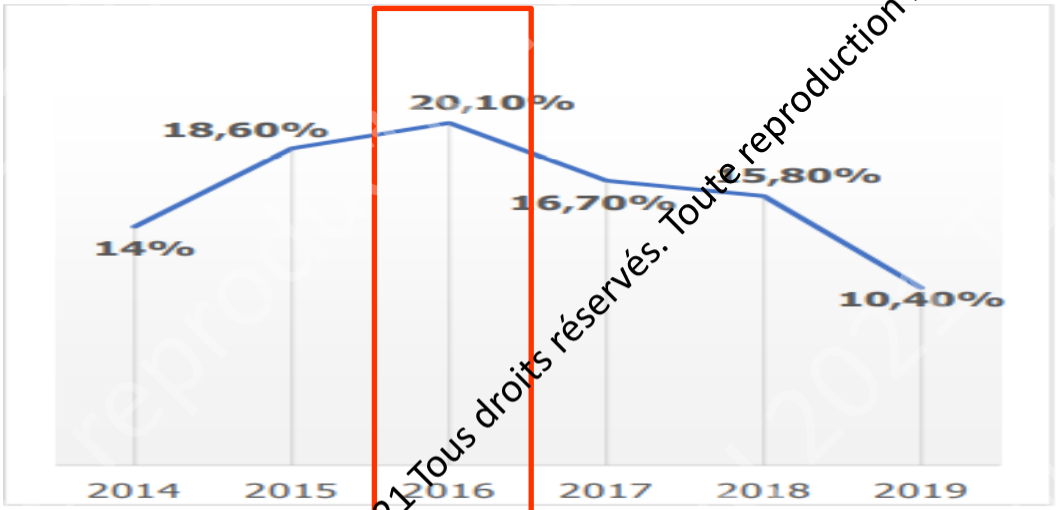


Figure 1. Annual evolution of the isolation rate of P. aeruginoa strains

P. æruginosa was the leading bacteria of the TBC-BU ecology during the study period **(N=1384; 15.9%).**

The annual isolation rate of *P. æruginosa* peaked in 2016 (**20.1%**).

Then it gradually decreased to reach **10.4%** in 2019.

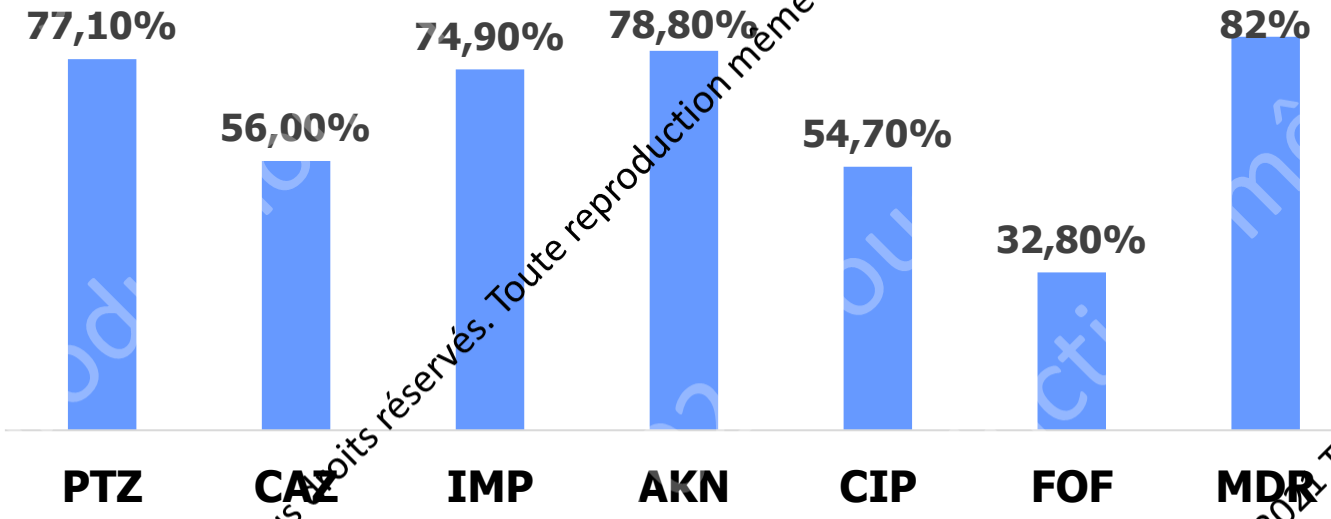
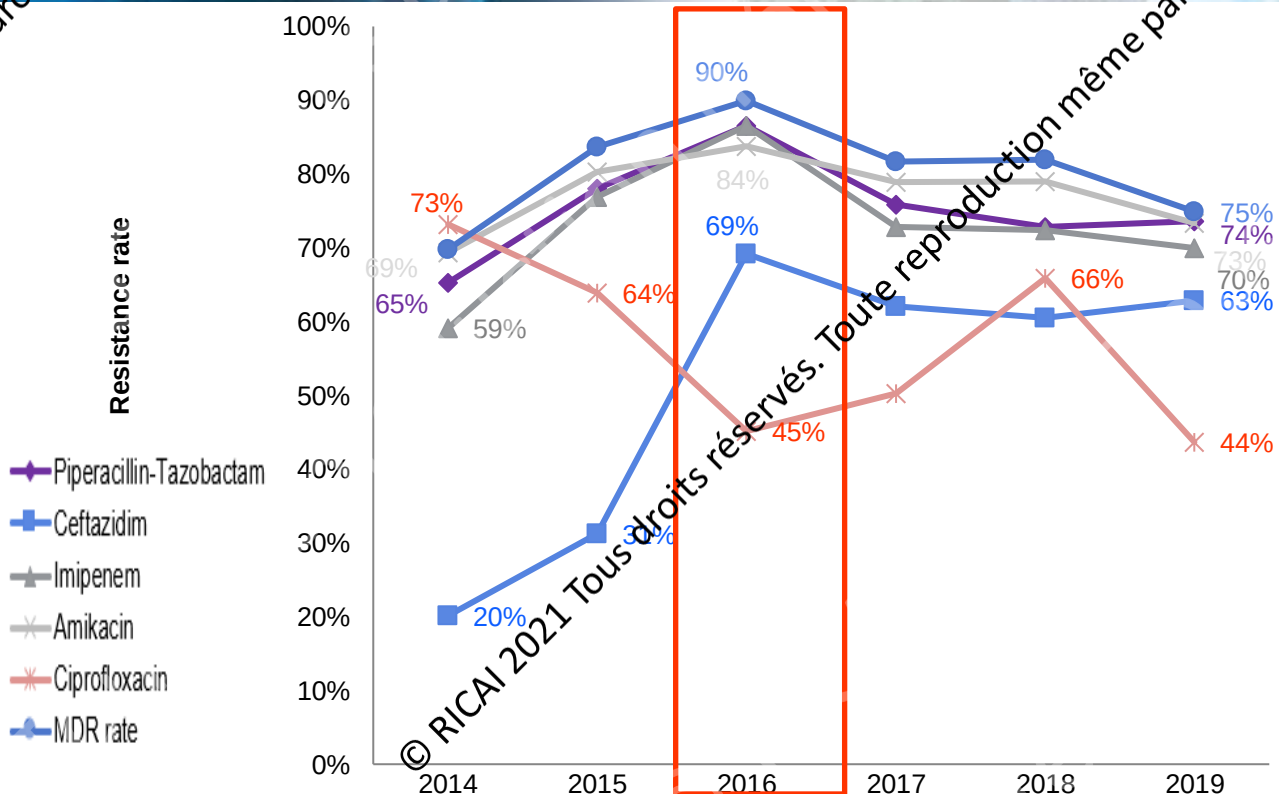


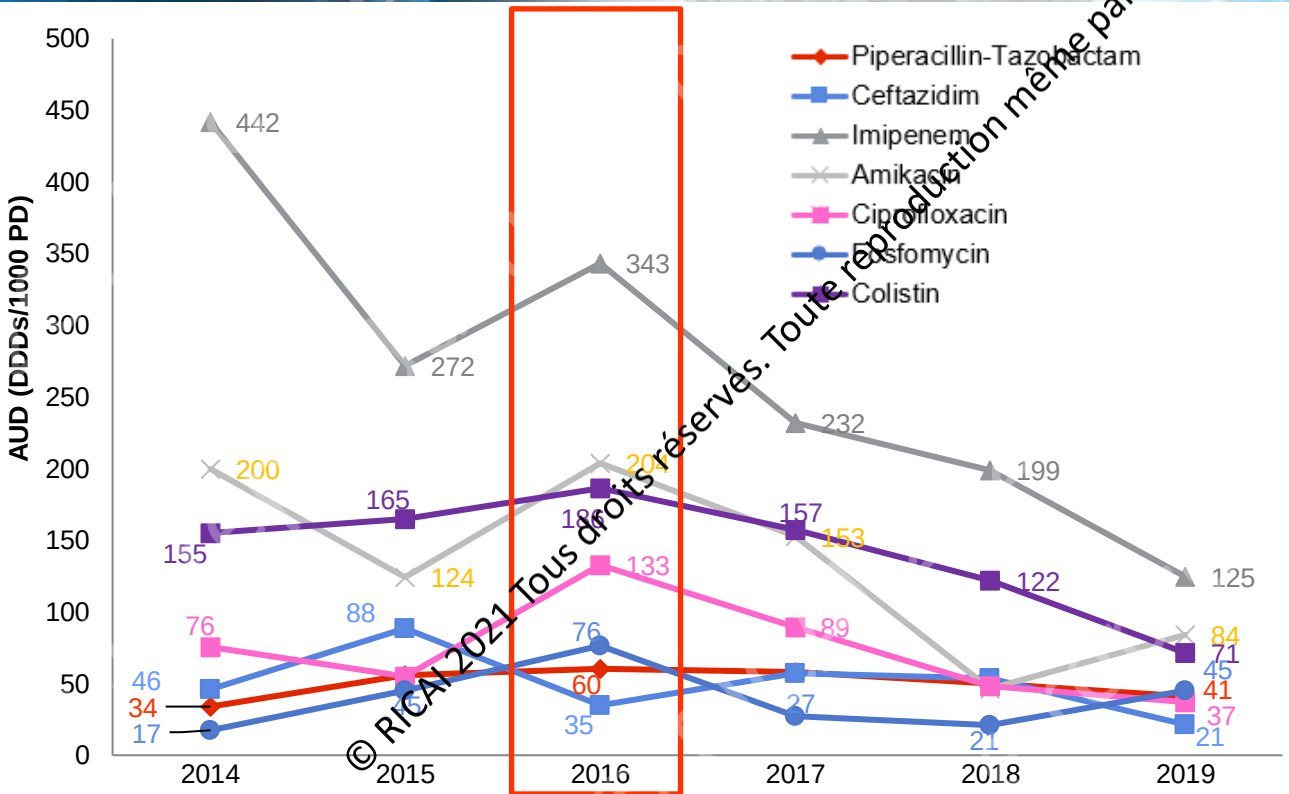
Figure 2. Resistance Rate to tested antibiotics during the study period [2014-2019]



Resistance rates to most tested antibiotics : Piperacillin-tazobactam, ceftazidime, imipenem and amikacin as well as MDR rate peaked in 2016.

All these rates increased significantly (rs=1; p<0.01) from 2014 to 2016.

The decrease between 2016 and 2019 was however statistically significant only for **imipenem (rs=-0.9; p<0.01)**



Imipenem consumption showed a significant downward trend throughout the study period (rs= -0.9; p=0.01).

Concomitantly, the consumption of **ciprofloxacin**, **colistin**, and **fosfomycin** peaked in 2016, then decreased between 2016 and 2019. This decrease was significant only for **ciprofloxacin and colistin (rs=-1; p<0.01).**

		AUD					
		PTZ	CAZ	IMP	AKN	CIP	FOF
Resistance rates	PTZ	**0,86 (*0,03*)**	0,03 (*0,96*)	-0,13 (*0,81*)	0,19 (*0,72*)	0,60 (*0,21*)	**0,88 (*0,02*)**
	CAZ	0,54 (*0,27*)	-0,50 (*0,32*)	-0,61 (*0,20*)	-0,28 (*0,59*)	0,25 (*0,63*)	0,45 (*0,37*)
	IMP	**0,88 (*0,02*)**	0,08 (*0,88*)	-0,18 (*0,73*)	0,07 (*0,89*)	0,56 (*0,28*)	**0,84 (*0,04*)**
	AKN	**0,96 (*0,002*)**	0,30 (*0,56*)	-0,17 (*0,75*)	-0,01 (*0,98*)	0,48 (*0,33*)	0,64 (*0,17*)
	CIP	-0,44 (*0,38*)	0,53 (*0,28*)	0,51 (*0,30*)	-0,02 (*0,98*)	-0,30 (*0,56*)	-0,68 (*0,14*)
	FOF	0,25 (*0,64*)	0,73 (*0,1*)	0,65 (*0,08*)	0,55 (*0,26*)	0,32 (*0,54*)	0,18 (*0,73*)
MDR rate		**0,94 (*0,005*)**	0,24 (*0,64*)	0,12 (*0,82*)	0,05 (*0,93*)	0,54 (*0,27*)	0,69 (*0,13*)

Table 1. Analysis of the correlation between antibiotic resistance and antibiotic consumption

- Consumption of piperacillin-tazobactam was correlated with resistance to :
  - Piperacillin-tazobactam (R=0.86; p=0.03),
  - Imipenem (R=0.88; p=0.02)
  - Amikacin (R=0.96; p<0.01)
  - MDR rate (R=0.94; p<0.01)
- Similarly, consumption of fosfomycin was correlated with resistance to :
  - piperacillin-tazobactam (R=0.89; p=0.02)
  - imipenem (R=0.84; p=0.04).

Conclusion

- Our study showed that resistance rates as well as the consumption of antipseudomonal drugs have decreased particularly from 2016 to 2019.
- But these rates remain high, despite their relative decline, with a positive and significant correlation between these two variables, with a correlation between resistance rates in *P. æruginosa* and consumption of **piperacillin-tazobactam** and **fosfomycin +++**

➔ **Better management of these antibiotics is mandatory to reduce the high resistance rates in *P. æruginosa*.**