

**Antibiotic resistance of *S. aureus*  
in Tunisia  
A multicentric study (2004 – 2008)**

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# *S. aureus*

## ■ **A serious pathogen:**

- **Non invasive and invasive infections** (virulence factors )

- **Antibiotic aquired resistance : SARM**

  - Hospital aquired –SARM

  - Community aquired –SARM



**Problem of multidrug resistance**

**Rates of MRSA varying according to the countries**

**Necessity of antimicrobial resistance surveillance**

# Multicentric study

## ■ 3 University hospitals

- Hôpital Ch. Nicolle – Tunis (HCN) : Multidisciplinary
- Hôpital d'Enfants – Tunis (HET) : Pediatric Hospital
- Hôpital H. Bourguiba/H. Chaker – Sfax (CHS) : Multidisciplinary

## ■ Methodology :

- Antibiotic susceptibility testing : Diffusion method on MH agar
- Quality control
- MRSA detection : oxacillin, ceftiofime (screening)  
MICs, PBP2a ou *mec A* gene

## ■ Data collection (WHONET)

- Non duplicated isolates
- statistical analysis

## Distribution of *S. aureus* isolates according to wards

|                    | 2004<br>(1045 ) |      | 2005<br>(1165) |      | 2006<br>(1164) |    | 2007<br>(1097) |      | 2008<br>(1177) |      |
|--------------------|-----------------|------|----------------|------|----------------|----|----------------|------|----------------|------|
|                    | Nb              | %    | Nb             | %    | Nb             | %  | Nb             | %    | Nb             | %    |
| <b>surgery</b>     | 261             | 24.9 | 269            | 23.1 | 245            | 21 | 246            | 22.4 | 292            | 24.8 |
| <b>Gyneco</b>      | 25              | 2,4  | 28             | 2,4  | 23             | 2  | 27             | 8.8  | 21             | 1.7  |
| <b>Medicine</b>    | 310             | 29.6 | 291            | 25.0 | 318            | 28 | 289            | 26.3 | 351            | 28.8 |
| <b>Pediatrics</b>  | 280             | 26.8 | 374            | 32.1 | 372            | 32 | 386            | 35   | 321            | 27.7 |
| <b>Neonat</b>      | 12              | 1.1  | 16             | 1.4  | 16             | 1  | 0              | 0    | 5              | 0.8  |
| <b>ICUs</b>        | 114             | 10.9 | 180            | 15.5 | 163            | 14 | 124            | 11   | 145            | 12.3 |
| <b>Outpatients</b> | 43              | 4.1  | 7              | 0.6  | 27             | 2  | 11             | 1    | 39             | 3.3  |

## Distribution of *S. aureus* isolates according to specimens (2004 - 2008)

|              | 2004<br>(1045 ) |           | 2005<br>(1165) |           | 2006<br>(1164) |           | 2007<br>(1097) |             | 2008<br>(1177) |             |
|--------------|-----------------|-----------|----------------|-----------|----------------|-----------|----------------|-------------|----------------|-------------|
|              | Nb              | %         | Nb             | %         | Nb             | %         | Nb             | %           | Nb             | %           |
| <b>Pus</b>   | <b>521</b>      | <b>50</b> | <b>651</b>     | <b>57</b> | <b>658</b>     | <b>56</b> | <b>669</b>     | <b>60.9</b> | <b>626</b>     | <b>53.3</b> |
| <b>Blood</b> | <b>218</b>      | <b>21</b> | <b>199</b>     | <b>17</b> | <b>222</b>     | <b>19</b> | <b>189</b>     | <b>17.2</b> | <b>182</b>     | <b>15.5</b> |
| Urines       | 83              | 8         | 92             | 8         | 88             | 7.5       | 61             | 5.5         | 97             | 8.2         |
| Pulm         | 101             | 10        | 93             | 8         | 112            | 9.5       | 65             | 5.9         | 109            | 9.2         |
| Punctions    | 45              | 3         | 35             | 3         | 43             | 3.6       | 46             | 4.1         | 39             | 3.3         |
| others       | 77              | 8         | 80             | 7         | 41             | 3.5       | 40             | 3.6         | 121            | 10.5        |

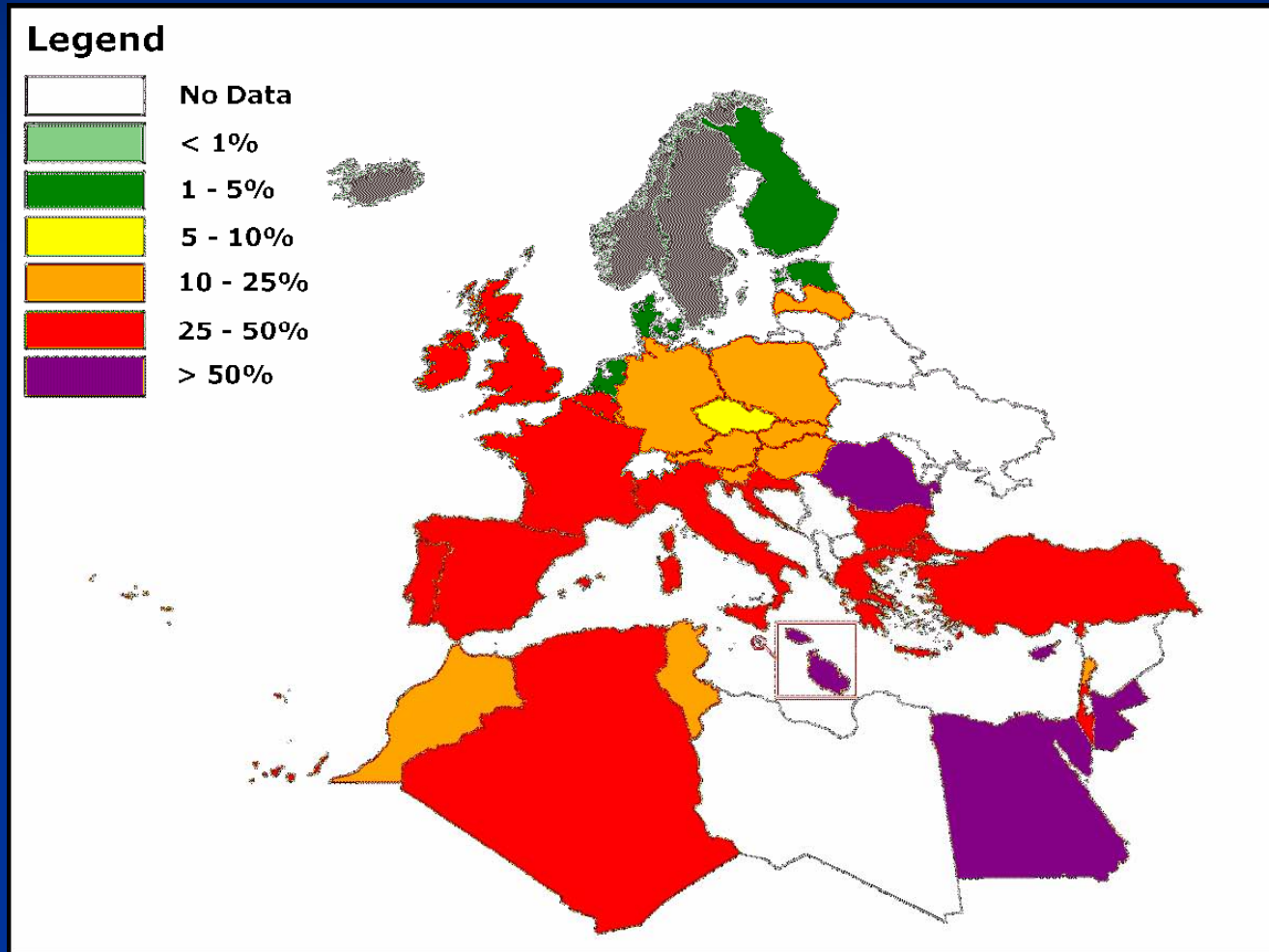
## % of antibiotic resistance of *S. aureus* (2004-2008)

| ATB              | 2004<br>(935) | 2005<br>(1014) | 2006<br>(1075) | 2007<br>(1075) | 2008<br>(1056) |
|------------------|---------------|----------------|----------------|----------------|----------------|
|                  | R + I         | R + I          | R + I          | R + I          | R+I            |
| <b>Peni /Amx</b> | 92            | 92             | 91.3           | 91.2           | 91.5           |
| <b>Oxa</b>       | 18            | 18.3           | 21.6           | 20.1           | 16.3           |
| <b>K/An</b>      | 29.3          | 25.6           | 33             | 29.1           | 22.3           |
| <b>Gm</b>        | 7.3           | 7.6            | 6.7            | 3.4            | 5.3            |
| <b>Tb</b>        | 9.3           | 11             | 12.6           | 9.7            | 7.3            |
| <b>E</b>         | 21            | 19.9           | 26.2           | 22.6           | 15.2           |
| <b>L/ Clin</b>   | 5             | 5.3            | 12.7           | 5.3            | 4.9            |
| <b>Pris</b>      | 0             | 0              | 0.4            | 0.9            | 0.5            |
| <b>Te</b>        | 48.3          | 42.6           | 42.8           | 43.3           | 35.5           |
| <b>C</b>         | 1.3           | 3.9            | 3.4            | 3.6            | 2              |
| <b>Sxt</b>       | 5.3           | 6.6            | 4.8            | 2.6            | 1.7            |
| <b>Rif</b>       | 11            | 10.6           | 12.1           | 8.2            | 6.1            |
| <b>Fos</b>       | 1.5           | 5              | 5.4            | 1.8            | 3.3            |
| <b>Ofx</b>       | 7             | 8.9            | 14             | 9.3            | 4.5            |
| <b>Van</b>       | 0             | 0              | 0              | 0              | 0              |
| <b>Tei</b>       | 0             | 0              | 0              | 0              | 0              |

## % of antibiotic resistance of *S. aureus* in blood cultures

|                    | <b>2004</b><br><b>(211)</b> | <b>2005</b><br><b>(193)</b> | <b>2006</b><br><b>(194)</b> | <b>2007</b><br><b>(189)</b> | <b>2008</b><br><b>(177)</b> |
|--------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
|                    | <b>R+I</b>                  | <b>R+I</b>                  | <b>R+I</b>                  | <b>R+I</b>                  | <b>R+I</b>                  |
| <b>Péni G/ Amx</b> | <b>91.5</b>                 | <b>94</b>                   | <b>94.2</b>                 | <b>91.3</b>                 | <b>91</b>                   |
| <b>Oxa</b>         | <b>22</b>                   | <b>19</b>                   | <b>26.4</b>                 | <b>20.7</b>                 | <b>19.3</b>                 |
| <b>K/An</b>        | <b>31.6</b>                 | <b>30</b>                   | <b>38.7</b>                 | <b>22.6</b>                 | <b>32.7</b>                 |
| <b>Gm</b>          | <b>14.3</b>                 | <b>11</b>                   | <b>12</b>                   | <b>2</b>                    | <b>6.6</b>                  |
| <b>Tb</b>          | <b>17.3</b>                 | <b>13.3</b>                 | <b>18.9</b>                 | <b>9.9</b>                  | <b>12.2</b>                 |
| <b>E</b>           | <b>26.3</b>                 | <b>21</b>                   | <b>38.9</b>                 | <b>22.5</b>                 | <b>18.9</b>                 |
| <b>L/ Clin</b>     | <b>5.6</b>                  | <b>9.3</b>                  | <b>8.3</b>                  | <b>7</b>                    | <b>3.8</b>                  |
| <b>Pris</b>        | <b>0</b>                    | <b>0</b>                    | <b>0</b>                    | <b>0</b>                    | <b>0</b>                    |
| <b>Té</b>          | <b>39.6</b>                 | <b>52.3</b>                 | <b>42.5</b>                 | <b>36.8</b>                 | <b>38.3</b>                 |
| <b>C</b>           | <b>1.3</b>                  | <b>0.6</b>                  | <b>5.5</b>                  | <b>3.4</b>                  | <b>1.4</b>                  |
| <b>Sxt</b>         | <b>11.3</b>                 | <b>5.6</b>                  | <b>8</b>                    | <b>3.2</b>                  | <b>3.9</b>                  |
| <b>Rif</b>         | <b>15</b>                   | <b>10.6</b>                 | <b>14.1</b>                 | <b>3.1</b>                  | <b>7.5</b>                  |
| <b>Fos</b>         | <b>5.5</b>                  | <b>4</b>                    | <b>4.7</b>                  | <b>3.3</b>                  | <b>2.7</b>                  |
| <b>Ofx</b>         | <b>13.3</b>                 | <b>13</b>                   | <b>17.7</b>                 | <b>7.6</b>                  | <b>9</b>                    |
| <b>Van</b>         | <b>0</b>                    | <b>0</b>                    | <b>0</b>                    | <b>0</b>                    | <b>0</b>                    |
| <b>Tei</b>         | <b>0</b>                    | <b>0</b>                    | <b>0</b>                    | <b>0</b>                    | <b>0</b>                    |

# MRSA in blood cultures EARSS et ARMED (2003-2005)



<http://www.slh.gov.mt/armed/microbial.asp>



# Incidence of MRSA according to wards

|              | 2004                  |             | 2005                  |             | 2006                  |             | 2007                  |             | 2008                  |             |
|--------------|-----------------------|-------------|-----------------------|-------------|-----------------------|-------------|-----------------------|-------------|-----------------------|-------------|
|              | Nb MRSA (Nb S.a)      | %           | Nb MRSA (Nb S.a)      | %           | Nb MRSA (Nb S.a)      | %           | Nb MRSA (Nb S.a)      | %           | Nb MRSA (Nb S.a)      | %           |
| Surgery      | 44<br>(261)           | 16.8        | 52<br>(269)           | 19.3        | 55<br>(245)           | 22.4        | 42<br>(246)           | 17          | (292)<br>39           | 13.3        |
| Gyneco       | 2<br>(25)             | 8           | 4<br>(28)             | 14.2        | 0<br>(23)             | 0           | 4<br>(27)             | 14.8        | 1<br>(21)             | 4.7         |
| Medicine     | 47<br>(310)           | 21.6        | 68<br>(291)           | 23.3        | 62<br>(318)           | 19.4        | 68<br>(289)           | 23.5        | 41<br>(351)           | 11.6        |
| Pediatrics   | 44<br>(280)           | 15.7        | 47<br>(374)           | 12.6        | 84<br>(384)           | 21.8        | 96<br>(386)           | 24.8        | 67<br>(321)           | 20.8        |
| Neonat.      | 0<br>(12)             | 0           | 0<br>(16)             | 0           | 0<br>(16)             | 0           | 0<br>(0)              | 0           | 0<br>(5)              | 0           |
| ICUs         | 48<br>(114)           | 42          | 79<br>(180)           | 43          | 40<br>(163)           | 24.5        | 15<br>(124)           | 12          | 20<br>(145)           | 13.8        |
| Outpatients  | 1<br>(43)             | 2.3         | 1<br>(7)              | 14.2        | 4<br>(27)             | 14.8        | 4<br>(11)             | 15.4        | 5<br>(39)             | 12.6        |
| <b>Total</b> | <b>186<br/>(1045)</b> | <b>18.3</b> | <b>235<br/>(1164)</b> | <b>18.3</b> | <b>247<br/>(1165)</b> | <b>21.9</b> | <b>229<br/>(1097)</b> | <b>20.1</b> | <b>177<br/>(1177)</b> | <b>16.3</b> |

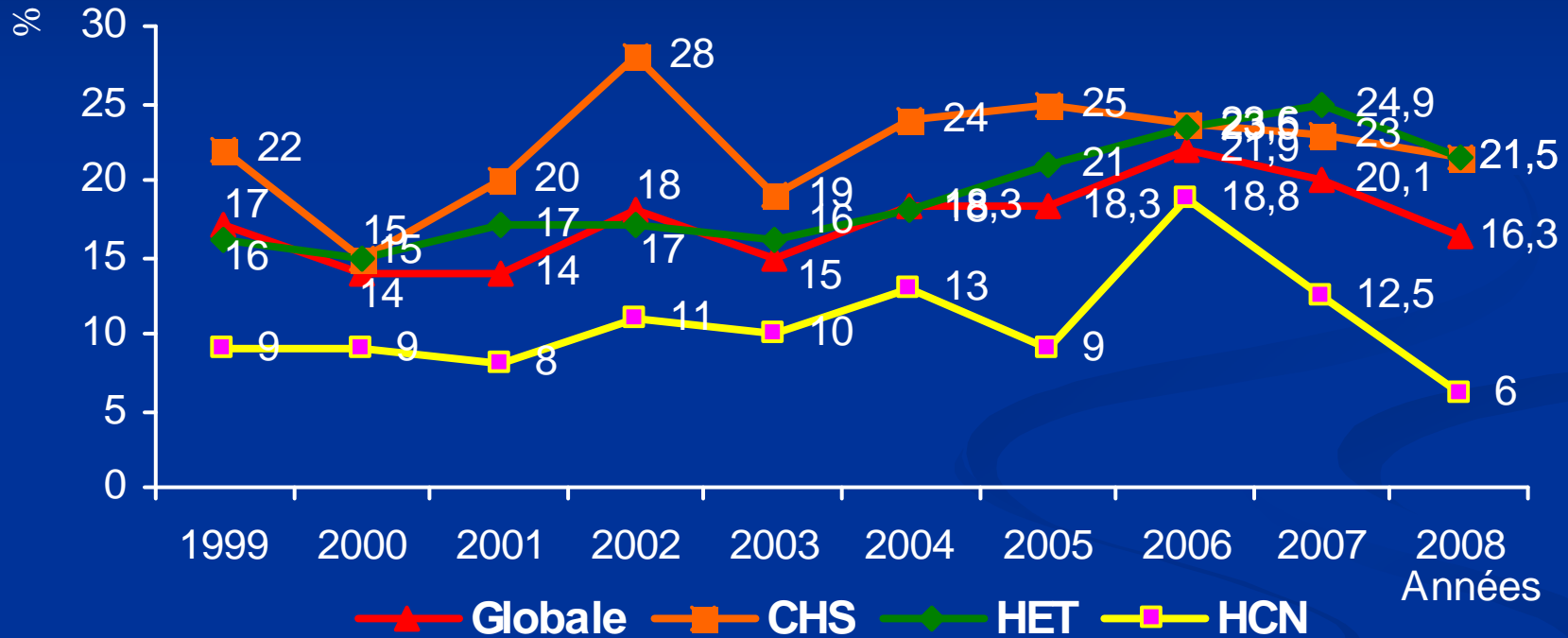
## Incidence of MRSA according to specimens

|                         | 2004                   |             | 2005                   |             | 2006                   |             | 2007                   |             |
|-------------------------|------------------------|-------------|------------------------|-------------|------------------------|-------------|------------------------|-------------|
|                         | Nb<br>MRSA<br>(Nb S.a) | %           | Nb<br>MRSA<br>(Nb S.a) | %           | Nb<br>MRSA<br>(Nb S.a) | %           | Nb<br>MRSA<br>(Nb S.a) | %           |
| <b>Pus</b>              | 86<br>(521)            | <b>16.5</b> | 126<br>(651)           | <b>19.3</b> | 132<br>(658)           | <b>20</b>   | 146<br>(669)           | <b>21.8</b> |
| <b>Blood</b>            | 47<br>(218)            | <b>21.5</b> | 43<br>(199)            | <b>21.6</b> | 57<br>(222)            | <b>25.6</b> | 37<br>(189)            | <b>19.5</b> |
| <b>Urines</b>           | 9<br>(83)              | 10.8        | 14<br>(92)             | 15.2        | 10<br>(88)             | 11.3        | 6<br>(61)              | 9.8         |
| <b>Pulm</b>             | 21<br>(101)            | <b>20.7</b> | 26<br>(93)             | <b>27.9</b> | 27<br>(112)            | <b>24</b>   | 11<br>(65)             | <b>16.9</b> |
| <b>Punct°<br/>fluid</b> | 6<br>(45)              | 13.3        | 6<br>(35)              | 17.1        | 10<br>(43)             | <b>23.2</b> | 9<br>(46)              | <b>19.5</b> |
| <b>Others</b>           | 17<br>(77)             | 22          | 20<br>(80)             | 25          | 11<br>(41)             | 26.8        | 5<br>(40)              | 12.5        |

## MRSA : % of associated resistance (2004-2008)

| ATB    | 2004<br>(176) | 2005<br>(235) | 2006<br>(234) | 2007<br>(226) | 2008<br>(177) |
|--------|---------------|---------------|---------------|---------------|---------------|
|        | R+I           | R+I           | R+I           | R+I           | R+I           |
| K/ An  | <b>89.3</b>   | <b>87.3</b>   | <b>83.6</b>   | <b>88.9</b>   | <b>89</b>     |
| Gm     | <b>35</b>     | <b>42.3</b>   | <b>29.6</b>   | <b>20.5</b>   | <b>18.9</b>   |
| Tb     | <b>46.3</b>   | <b>49.3</b>   | <b>28.3</b>   | <b>36.2</b>   | <b>35.9</b>   |
| E      | <b>43.2</b>   | <b>50.3</b>   | <b>51.8</b>   | <b>49</b>     | <b>29.8</b>   |
| L/Clin | 9.9           | 19            | 18.5          | 11.5          | 15            |
| Pris   | 0             | 0             | <b>0.3</b>    | <b>0.9</b>    | <b>1.4</b>    |
| Ofx    | <b>33.9</b>   | <b>42.6</b>   | <b>39.9</b>   | <b>36.3</b>   | <b>30.4</b>   |
| Sxt    | 29.6          | 30.6          | 14.5          | 11.9          | 9.3           |
| Rif    | <b>36.3</b>   | <b>40.3</b>   | <b>32.1</b>   | <b>24</b>     | <b>28.5</b>   |
| Van    | 0             | 0             | 0             | 0             | 0             |
| Tei    | 0             | 0             | 0             | 0             | 0             |

# Trends of MRSA in Tunisia 1999-2008



# MRSA in Tunisia

- Steady rates of resistance : <25%
- Good activity of glycopeptides : no decreased susceptibility detected
- Vigilance +++