# Antibiograms of Carbapenemase Producing Organisms - June, 2016

Notes: Carbapenemase producing organism isolates identified or submitted to the Microbiological Diagnostic Unit Public Health Laboratory (MDU PHL) between 01/01/2012 and 31/02/2016, with susceptibility data tested by VITEK 2 (bioMérieux) are included in the analysis below. All organism and carbapenemase gene combinations comprising fewer than five isolates have been excluded. Aggregate antibiograms are categorised by carbapenemase gene sub-type(s) and isolates may contain other antimicrobial resistance (AMR) mechanisms not indicated. Carbapenemase genes tested by PCR include blaKPC, blaIMP, blaNDM, blaVIM, blaOXA-23-like, blaOXA-24/40-like, blaOXA-48-like, blaOXA-51-like and blaOXA-58-like. Carbapenemase gene subtypes have been determined by Sanger sequencing or whole genome sequence analysis. CLSI breakpoints have been used for all susceptibility interpretation, except piperacillin tazobactam in *Pseudomonas* and *Serratia* species, which have been interpreted using EUCAST guidelines[1,2]. Intermediate susceptibility included as non-susceptible in aggregate antibiograms.

**Table 1: Aggregate antibiogram, carbapenemase producing organisms isolates by number and percantage susceptible to each antimicrobial on VITEK 2, received by MDU PHL 01/01/2012-31/05/2016**

| | | | Number susceptible (%) | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CPO gene(s)** | **Organism** | **N** | Ampicillin | Amoxicillin Clavulanic Acid | Ticarcillin Clavulanic Acid | Piperacillin Tazobactam | Meropenem | Cefazolin | Cefoxitin | Ceftriaxone | Ceftazidime | Cefepime | Ciprofloxacin | Norfloxacin | Tobramycin | Gentamicin | Amikacin | Nitrofurantoin | Trimethoprim | Cotrimoxazole |
| **IMP-4** | *P. aeruginosa* | 11 | | | 0 (0%) | 1 (9%) | 0 (0%) | | | | 0 (0%) | 0 (0%) | 0 (0%) | | 0 (0%) | 4 (36%) | 6 (55%) | | | |
| | *C. freundii* | 6 | 0 (0%) | 0 (0%) | 0 (0%) | 1 (17%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 2 (33%) | 5 (83%) | 6 (100%) | 0 (0%) | 0 (0%) | 6 (100%) | | 5 (83%) | 5 (83%) |
| | *E. cloacae complex* | 17 | 0 (0%) | 1 (6%) | 0 (0%) | 3/14 (21%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 7 (41%) | 12 (71%) | 13 (76%) | 0 (0%) | 1 (6%) | 17 (100%) | | 6 (35%) | 6 (35%) |
| | *E. coli* | 9 | 0 (0%) | 0 (0%) | 0 (0%) | 4/8 (50%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 7 (78%) | 8 (89%) | 8 (89%) | 1 (11%) | 1 (11%) | 9 (100%) | 7 (78%) | 4 (44%) | 4 (44%) |
| | *K. oxytoca* | 9 | 0 (0%) | 1 (11%) | 0 (0%) | 2 (22%) | 1 (11%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 9 (100%) | 8 (89%) | 9 (100%) | 0 (0%) | 1 (11%) | 9 (100%) | | 9 (100%) | 9 (100%) |
| | *K. pneumoniae* | 17 | 0 (0%) | 0 (0%) | 0 (0%) | 3 (18%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 9 (53%) | 15 (88%) | 15 (88%) | 0 (0%) | 0 (0%) | 17 (100%) | | 8 (47%) | 8 (47%) |
| | *S. marcescens* | 31 | 0 (0%) | 0 (0%) | 2 (6%) | 30 (97%) | 2 (6%) | 0 (0%) | 2 (6%) | 2 (6%) | 1 (3%) | 20 (65%) | 21 (68%) | 25 (81%) | 2 (6%) | 18 (58%) | 31 (100%) | | 29 (94%) | 28 (90%) |
| **KPC-2** | *C. farmeri* | 8 | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 2 (25%) | 2 (25%) | 0 (0%) | 0 (0%) | 8 (100%) | | 0 (0%) | 0 (0%) |
| | *K. pneumoniae* | 58 | 0 (0%) | 1 (2%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 1 (2%) | 0 (0%) | 0 (0%) | 19 (33%) | 1 (2%) | 1 (2%) | 1 (2%) | 55 (95%) | 7 (12%) | | 13 (22%) | 13 (22%) |
| **NDM-1** | *E. coli* | 7 | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 1 (14%) | 1 (14%) | 1 (14%) | 0 (0%) | 1 (14%) | 3 (43%) | 6 (86%) | 2 (29%) | 2 (29%) |
| | *K. pneumoniae* | 11 | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 2 (18%) | 0 (0%) | 0 (0%) | 2 (18%) | 5 (45%) | 6 (55%) | | 1 (9%) | 1 (9%) |
| **NDM-5** | *E. coli* | 10 | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 1 (10%) | 1 (10%) | 2 (20%) | 2 (20%) | 5 (50%) | 6 (60%) | 0 (0%) | 1 (10%) |
| | *K. pneumoniae* | 7 | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 2 (29%) | 2 (29%) | 1 (14%) | 2 (29%) | 3 (43%) | | 2 (29%) | 2 (29%) |
| **NDM-5, OXA-232** | *K. pneumoniae* | 9 | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | | 0 (0%) | 0 (0%) |
| **OXA-232** | *K. pneumoniae* | 11 | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 1 (9%) | 0 (0%) | 1 (9%) | 1 (9%) | 3 (27%) | 3 (27%) | 1 (9%) | 1 (9%) | 1 (9%) | 4 (36%) | 5 (45%) | | 1 (9%) | 1 (9%) |
| **OXA-181** | *E. coli* | 11 | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 5 (45%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 1 (9%) | 0 (0%) | 0 (0%) | 2 (18%) | 4 (36%) | 11 (100%) | 2 (18%) | 3 (27%) | 3 (27%) |
| **OXA-48** | *E. coli* | 7 | 0 (0%) | 0 (0%) | 0 (0%) | 0/6 (0%) | 1 (14%) | 0 (0%) | 2 (29%) | 0 (0%) | 4 (57%) | 6 (86%) | 5 (71%) | 5 (71%) | 5 (71%) | 5 (71%) | 7 (100%) | 5 (71%) | 2 (29%) | 2 (29%) |
| | *K. pneumoniae* | 13 | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 6 (46%) | 0 (0%) | 6 (46%) | 4 (31%) | 5 (38%) | 8 (62%) | 5 (38%) | 5 (38%) | 5 (38%) | 5 (38%) | 10 (77%) | | 0 (0%) | 3 (23%) |
| **OXA-23-like, OXA-51-like** | *A. calcoaceticus-baumannii complex* | 16 | | | 0 (0%) | 0 (0%) | 0 (0%) | | | | 1 (6%) | 0 (0%) | 0 (0%) | | 4 (25%) | 1 (6%) | 11 (69%) | | | 8 (50%) |

[1] CLSI. *Performance Standards for Antimicrobial Susceptibility Testing; Twenty-Third Informational Supplement.* CLSI document M100-S23. Wayne, PA: Clinical and Laboratory Standards Institute; 2013.

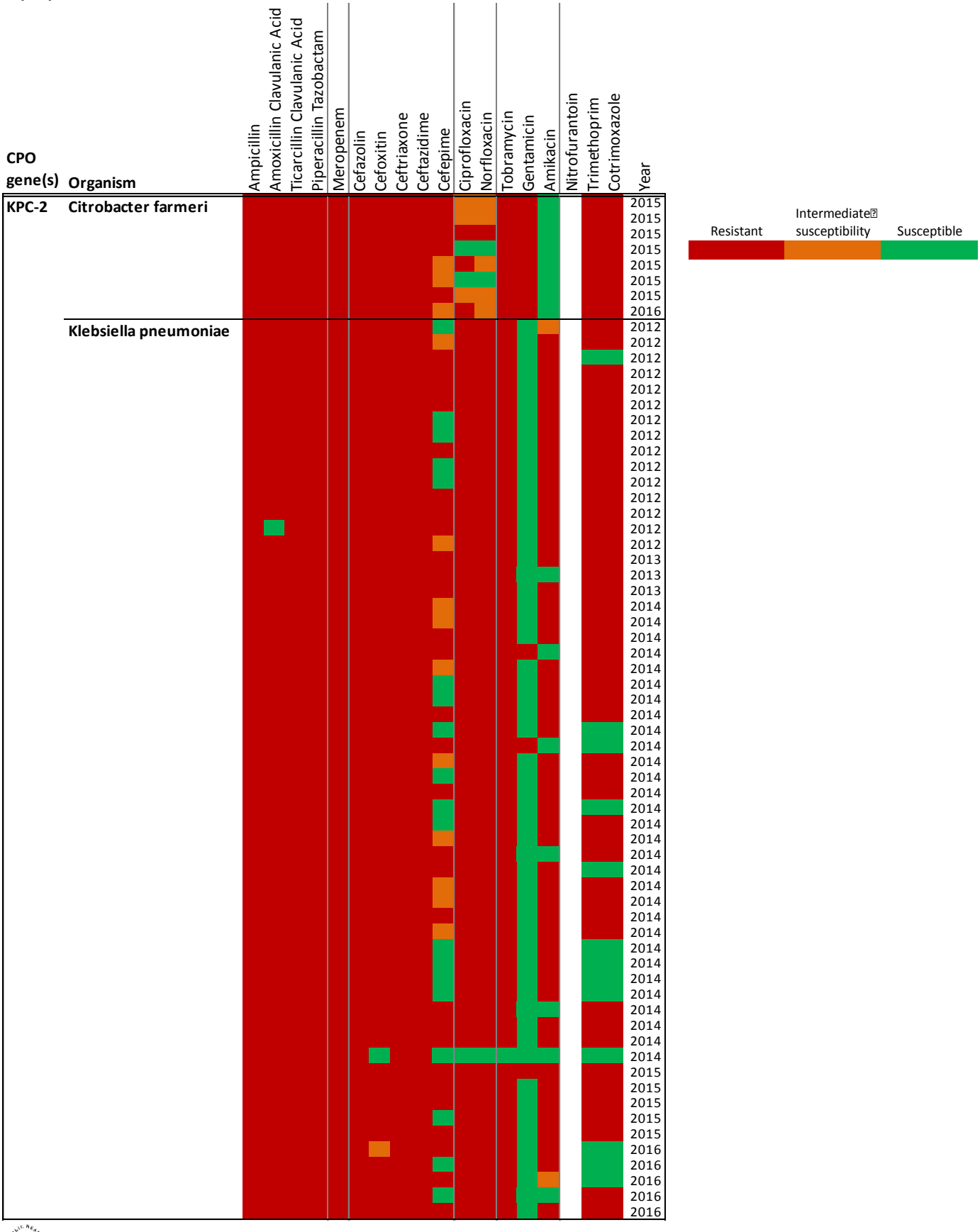
[2] The European Committee on Antimicrobial Susceptibility Testing. *Breakpoint Tables for Interpretation of MICs and Zone Diameters*. Version 6.0, 2016. Available: http://www.eucast.org

**Percentage susceptible** 0-20% | 21-40% | 41-60% | 61-80% | 81-100%

# Antibiograms of Carbapenemase Producing Organisms - June, 2016

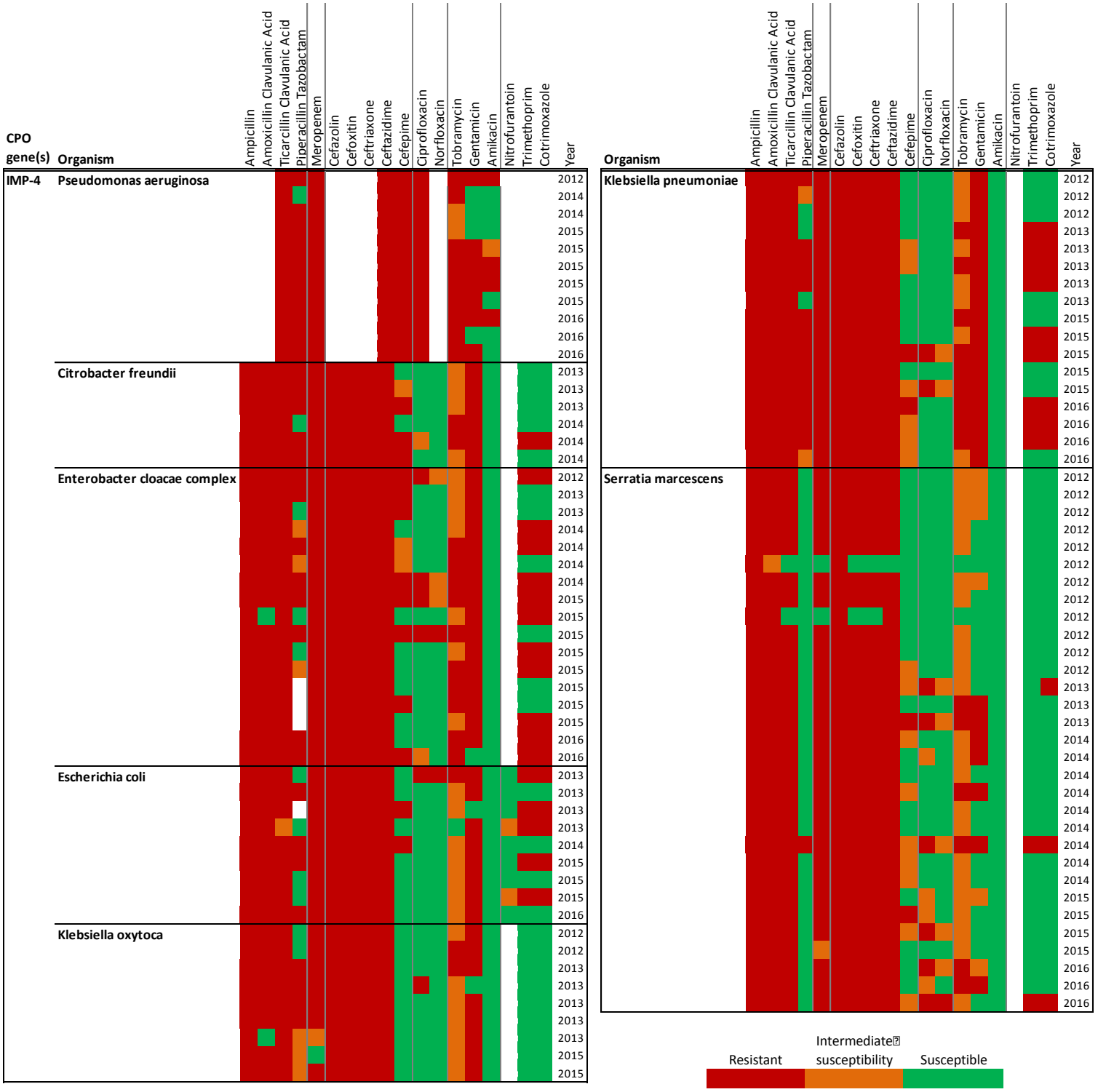
Notes: Each row in the follow individual isolate graphical antibiograms corresponds to one isolate of the specified carbapenemase gene and organism combination. For further information, please see notes on page 1.

**Table 2a: Individual isolate graphical antibiograms by VITEK 2, KPC-2 producing organisms, received by MDU PHL 01/01/2012-31/05/2016**



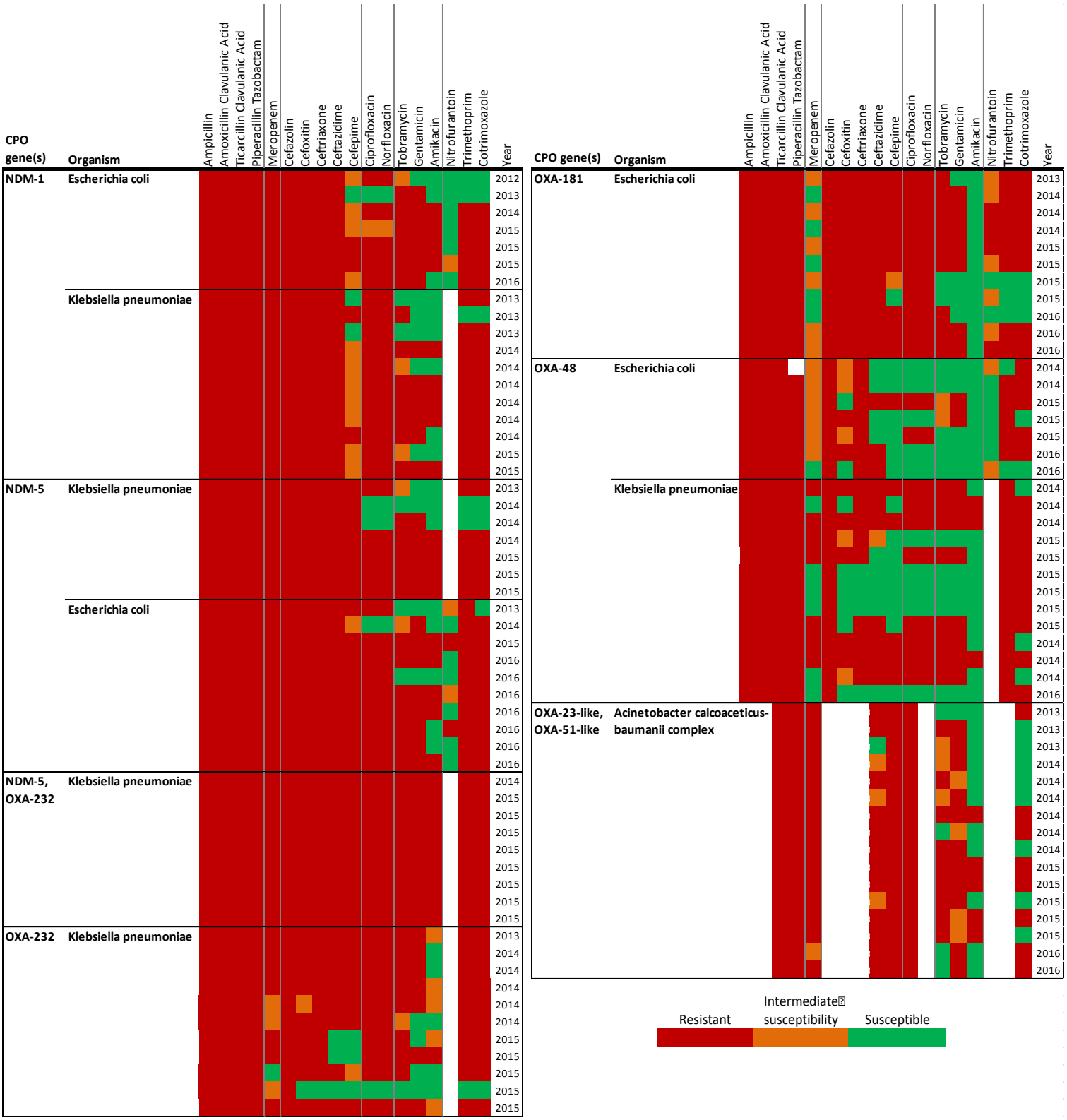
# Antibiograms of Carbapenemase Producing Organisms - June, 2016

**Table 2b: Individual isolate graphical antibiograms by VITEK 2, IMP-4 producing organisms, received by MDU PHL 01/01/2012-31/05/2016**



# Antibiograms of Carbapenemase Producing Organisms - June, 2016

**Table 2c: Individual isolate graphical antibiograms by VITEK 2, NDM and/or OXA producing organisms, received by MDU PHL 01/01/2012-31/05/2016**



# Antibiograms of Carbapenemase Producing Organisms - June, 2016

Notes: Each row in the follow individual isolate graphical antibiograms corresponds to one isolate of the specified carbapenemase gene and organism combination. Travel location data collection methods have varied across the included time period and data are not complete. Absence of travel location should not imply location acquisition. Where known, cases have been classified by country and region of travel in the 12 months prior to isolation. Please note, patients reporting multiple risk factors for CPO acquisition have not been excluded, and additional risk factors and/or travel locations may be present. As such, acquisition of CPE may not have occurred in the categorised location. For further information, please see notes on page 1.

**Table 3: Individual isolate graphical antibiograms by VITEK 2 amongst those reporting travel in 12 months prior to isolation, by country of travel, received by MDU PHL 01/01/2012-31/05/2016**

| Travel group | Gene | Organism | Travel location(s) (12 months prior to identification) | Overseas healthcare contact | Ampicillin | Amoxicillin Clavulanic Acid | Ticarcillin Clavulanic Acid | Piperacillin Tazobactam | Meropenem | Meropenem MIC | Cefazolin | Cefoxitin | Ceftriaxone | Ceftazidime | Cefepime | Ciprofloxacin | Norfloxacin | Tobramycin | Gentamicin | Amikacin | Nitrofurantoin | Trimethoprim | Cotrimoxazole | Year |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Greece | KPC-2 | Klebsiella pneumoniae | Greece~ | Yes | | | | | | ≥16 | | | | | | | | | | | | | | 2014 |
| | | | Greece~ | Yes | | | | | | ≥16 | | | | | | | | | | | | | | 2014 |
| | | | Greece~ | Yes | | | | | | ≥16 | | | | | | | | | | | | | | 2014 |
| | | | Greece~ | Yes | | | | | | ≥16 | | | | | | | | | | | | | | 2014 |
| | | | Greece~ | Yes | | | | | | ≥16 | | | | | | | | | | | | | | 2015 |
| | | | Greece~ | Yes | | | | | | ≥16 | | | | | | | | | | | | | | 2016 |
| | NDM-1 | Klebsiella pneumoniae | Greece~ | Yes | | | | | | ≥16 | | | | | | | | | | | | | | 2015 |
| | VIM-1 | Escherichia coli | Greece~ | Yes | | | | | | ≥16 | | | | | | | | | | | | | | 2015 |
| South east Asia | KPC-2 | Klebsiella pneumoniae | Vietnam~, Thailand~ | Yes | | | | | | ≥16 | | | | | | | | | | | | | | 2014 |
| | | | Vietnam | No | | | | | | ≥16 | | | | | | | | | | | | | | 2014 |
| | NDM-1 | Escherichia coli | Thailand~ | Yes | | | | | | ≥16 | | | | | | | | | | | | | | 2016 |
| | NDM-4 | Klebsiella pneumoniae | Vietnam~, Thailand~ | Yes | | | | | | ≥16 | | | | | | | | | | | | | | 2016 |
| | NDM-5 | Escherichia coli | Cambodia~, Vietnam | Yes | | | | | | ≥16 | | | | | | | | | | | | | | 2016 |
| | OXA-181 | Klebsiella pneumoniae | Vietnam~ | Yes | | | | | | ≥16 | | | | | | | | | | | | | | 2015 |
| | OXA-48 | Escherichia coli | Malaysia~, India, Egypt, Israel, Jordan | Yes | | | | | | 2 | | | | | | | | | | | | | | 2016 |
| India | NDM-5 | Escherichia coli | India~ | Yes | | | | | | 8 | | | | | | | | | | | | | | 2016 |
| | | | India~ | Yes | | | | | | ≥16 | | | | | | | | | | | | | | 2016 |
| | | | India~ | Yes | | | | | | ≥16 | | | | | | | | | | | | | | 2016 |
| | | | India~ | Yes | | | | | | ≥16 | | | | | | | | | | | | | | 2016 |
| | | | India | No | | | | | | ≥16 | | | | | | | | | | | | | | 2016 |
| | OXA-181 | Escherichia coli | India | No | | | | | | 2 | | | | | | | | | | | | | | 2015 |
| | | | India | No | | | | | | ≤0.25 | | | | | | | | | | | | | | 2015 |
| | | | Jordan, India | No | | | | | | 1 | | | | | | | | | | | | | | 2015 |
| | | | India~ | Yes | | | | | | 1 | | | | | | | | | | | | | | 2016 |
| | OXA-232 | Klebsiella pneumoniae | India~ | Yes | | | | | | ≥16 | | | | | | | | | | | | | | 2015 |
| | | | India~ | Yes | | | | | | ≥16 | | | | | | | | | | | | | | 2015 |
| | | | India~ | Yes | | | | | | ≥16 | | | | | | | | | | | | | | 2015 |
| Other | KPC-2 | Klebsiella pneumoniae | New Zealand | No | | | | | | ≥16 | | | | | | | | | | | | | | 2012 |
| | | | USA, New Zealand | No | | | | | | ≥16 | | | | | | | | | | | | | | 2016 |
| | NDM-5 | Escherichia coli | China~, USA, Europe NFS | No | | | | | | ≥16 | | | | | | | | | | | | | | 2016 |
| | OXA-48 | Escherichia coli | Lebanon~ | Yes | | | | | | 0.5 | | | | | | | | | | | | | | 2016 |
| | | Klebsiella pneumoniae | Malta~ | Yes | | | | | | 8 | | | | | | | | | | | | | | 2015 |
| | | | Turkey | No | | | | | | ≥16 | | | | | | | | | | | | | | 2015 |

~Location of hospitalisation or other healthcare contact