

## Daftar Pustaka

- Anonim, 2019. Carbapenem Resistance From Diagnostic to Outbreak Management.
- A. Jain, A. Awasthi, and M. Kumar, 2007. Etiological and antimicrobial susceptibility profile of nosocomial blood stream infections in neonatal intensive care unit, *Indian J. Med. Microbiol.* 25(3): 299–300.
- Abbott, I., Cerqueira, G.M., Bhuiyan, S., & Peleg, A.Y., 2013. Carbapenem resistance in *Acinetobacter baumannii*: Laboratory challenges, mechanistic insights and therapeutic strategies. *Expert Rev. Anti. Infect. Ther.* doi:10.1586/eri.13.21
- Abdelaziz, M.O., Bonura, C., Aleo, A., Fasciana, T., & Mammina, C., 2013. NDM-1- and OXA-163-producing *Klebsiella pneumoniae* isolates in Cairo, Egypt, 2012. *J. Glob. Antimicrob. Resist.* 1: 213–215. doi:10.1016/j.jgar.2013.06.003
- Ambler, R.P., 1980a. The structure of  $\beta$ -lactamases. *Philos. Trans. R. Soc. London. B, Biol. Sci.* 289: 321–331. doi:10.1098/rstb.1980.0049
- Ambler, R.P., 1980b. The structure of beta-lactamases. *Philos. Trans. R. Soc. Lond. B, Biol. Sci.* 289: 321–331. doi:10.1098/rstb.1980.0049
- Anderson, K.F., Lonsway, D.R., Rasheed, J.K., Biddle, J., Jensen, B., McDougal, L.K., et al., 2007. Evaluation of methods to identify the *Klebsiella pneumoniae* carbapenemase in Enterobacteriaceae. *J. Clin. Microbiol.* 45: 2723–2725. doi:10.1128/JCM.00015-07
- Aygun, F., Aygun, F.D., Varol, F., Durak, C., Çokuğraş, H., Camcıoğlu, Y., et al., 2019. Infections with carbapenem-resistant gram-negative bacteria are a serious problem among critically ill children: A single-centre retrospective study. *Pathogens* 8. doi:10.3390/pathogens8020069
- Baquero, F., 2001. Low-level antibacterial resistance: A gateway to clinical resistance. *Drug Resist. Updat.* doi:10.1054/drup.2001.0196
- Baughman, R.P., 2009. The use of carbapenems in the treatment of serious infections. *J. Intensive Care Med.* doi:10.1177/0885066609335660
- Ben-David, D., Maor, Y., Keller, N., Regev-Yochay, G., Tal, I., Shachar, D., et al., 2010. Potential Role of Active Surveillance in the Control of a Hospital-Wide Outbreak of Carbapenem-Resistant *Klebsiella pneumoniae* Infection. *Infect. Control Hosp. Epidemiol.* 31: 620–626. doi:10.1086/652528
- Ben-David, D., Masarwa, S., Navon-Venezia, S., Mishali, H., Fridental, I., Rubinovitch, B., et al., 2011. Carbapenem-Resistant *Klebsiella pneumoniae* in Post-Acute-Care Facilities in Israel. *Infect. Control Hosp. Epidemiol.* 32: 845–853. doi:10.1086/661279
- Bielicki, J.A., Cromwell, D.A., Johnson, A., Planche, T., & Sharland, M., 2017. Surveillance of Gram-negative bacteria: impact of variation in current European laboratory reporting practice on apparent multidrug resistance prevalence in paediatric bloodstream isolates. *Eur. J. Clin. Microbiol. Infect. Dis.* 36: 839–846. doi:10.1007/s10096-016-2869-4

- Bone, R.C., Balk, R.A., Cerra, F.B., Dellinger, R.P., Fein, A.M., Knaus, W.A., et al., 1992. Definitions for sepsis and organ failure and guidelines for the use of innovative therapies in sepsis, in: *Chest*. *Chest*, pp. 1644–1655. doi:10.1378/chest.101.6.1644
- Bonomo, R.A., Burd, E.M., Conly, J., Limbago, B.M., Poirel, L., Segre, J.A., et al., 2018. Carbapenemase-Producing Organisms: A Global Scourge. *Clin. Infect. Dis.* doi:10.1093/cid/cix893
- Bonomo, R.A., & Szabo, D., 2006. Mechanisms of multidrug resistance in *Acinetobacter* species and *Pseudomonas aeruginosa*, in: *Clinical Infectious Diseases*. doi:10.1086/504477
- Boutal, H., Vogel, A., Bernabeu, S., Devilliers, K., Creton, E., Cotellon, G., et al., 2018. A multiplex lateral flow immunoassay for the rapid identification of NDM-, KPC-, IMP- and VIM-type and OXA-48-like carbapenemase-producing Enterobacteriaceae. *J. Antimicrob. Chemother.* doi:10.1093/jac/dkx521
- Brink, A.J., 2019. Epidemiology of carbapenem-resistant Gram-negative infections globally. *Curr. Opin. Infect. Dis.* 609–616. doi:10.1097/QCO.0000000000000608
- Capone, A., Giannella, M., Fortini, D., Giordano, A., Meledandri, M., Ballardini, M., et al., 2013. High rate of colistin resistance among patients with carbapenem-resistant *Klebsiella pneumoniae* infection accounts for an excess of mortality. *Clin. Microbiol. Infect.* 19. doi:10.1111/1469-0691.12070
- Carvalhoes, C.G., Picão, R.C., Nicoletti, A.G., Xavier, D.E., & Gales, A.C., 2009. Cloverleaf test (modified Hodge test) for detecting carbapenemase production in *Klebsiella pneumoniae*: be aware of false positive results. *J. Antimicrob. Chemother.* 65: 249–251. doi:10.1093/jac/dkp431
- Caselli, D., Cesaro, S., Fagioli, F., Carraro, F., Ziino, O., Zanazzo, G., et al., n.d. Pediatric Hematology Oncology, Trieste, 6 Pediatric Oncology Unit. *Fond. IRCCS Ist. Naz. Tumori*. doi:10.3109/23744235.2015.1087647
- Cienfuegos-Gallet, A. V., Ocampo De Los Ríos, A.M., Sierra Viana, P., Ramirez Brinez, F., Restrepo Castro, C., Roncancio Villamil, G., et al., 2019. Risk factors and survival of patients infected with carbapenem-resistant *Klebsiella pneumoniae* in a KPC endemic setting: A case-control and cohort study. *BMC Infect. Dis.* 19: 830. doi:10.1186/s12879-019-4461-x
- Cleven, B.E.E., Palka-Santini, M., Gielen, J., Meembor, S., Krönke, M., & Krut, O., 2006. Identification and characterization of bacterial pathogens causing bloodstream infections by DNA microarray. *J. Clin. Microbiol.* 44: 2389–2397. doi:10.1128/JCM.02291-05
- Codjoe, F., & Donkor, E., 2017. Carbapenem Resistance: A Review. *Med. Sci.* 6: 1. doi:10.3390/medsci6010001
- Dahesih, D., Dewi, Y.P., Sugainli, A.K., & Parwati, I., 2019. SURVEILANS BAKTERI RESISTAN MULTI OBAT dan KEPEKAANNYA TERHADAP ANTIBIOTIK di RUMAH SAKIT INDONESIA TAHUN 2018.
- Daikos, G.L., Petrikos, P., Psychogiou, M., Kosmidis, C., Vryonis, E., Skoutelis, A., et al., 2009. Prospective observational study of the impact of VIM-1 metallo-β-

- lactamase on the outcome of patients with *Klebsiella pneumoniae* bloodstream infections. *Antimicrob. Agents Chemother.* 53: 1868–1873. doi:10.1128/AAC.00782-08
- Dautzenberg, M.J., Ossewaarde, J.M., de Kraker, M.E., van der Zee, A., van Burgh, S., de Greeff, S.C., et al., 2014. Successful control of a hospital-wide outbreak of OXA-48 producing enterobacteriaceae in the Netherlands, 2009 to 2011. *Eurosurveillance* 19. doi:10.2807/1560-7917.ES2014.19.9.20723
- Djordjevic, Z.M., Folic, M.M., Folic, N.D., Gajovic, N., Gajovic, O., & Jankovic, S.M., 2016. Risk factors for hospital infections caused by carbapenem-resistant *Acinetobacter baumannii*. *J. Infect. Dev. Ctries.* 10: 1073–1080. doi:10.3855/jidc.8231
- Dortet, L., Bréchard, L., Poirel, L., & Nordmann, P., 2014. Rapid detection of carbapenemase-producing Enterobacteriaceae from blood cultures. *Clin. Microbiol. Infect.* 20: 340–344. doi:10.1111/1469-0691.12318
- Dortet, L., Jousset, A., Sainte-Rose, V., Cuzon, G., & Naas, T., 2016. Prospective evaluation of the OXA-48 K-SeT assay, an immunochromatographic test for the rapid detection of OXA-48-type carbapenemases. *J. Antimicrob. Chemother.* 71: 1834–1840. doi:10.1093/jac/dkw058
- Dortet, Laurent, Poirel, L., & Nordmann, P., 2014. Worldwide dissemination of the NDM-Type carbapenemases in Gram-negative bacteria. *Biomed Res. Int.* 2014. doi:10.1155/2014/249856
- Falagas, M.E., Tansarli, G.S., Karageorgopoulos, D.E., & Vardakas, K.Z., 2014. Deaths attributable to carbapenem-resistant enterobacteriaceae infections. *Emerg. Infect. Dis.* 20: 1170–1175. doi:10.3201/eid2007.121004
- Fernández, L., & Hancock, R.E.W., 2012. Adaptive and Mutational Resistance : Role of Porins and Efflux Pumps in Drug Resistance 25: 661–681. doi:10.1128/CMR.00043-12
- Ferreira, F.L., 2001. Serial Evaluation of the SOFA Score 286.
- Fritzenwanker, M., Imirzalioglu, C., Herold, S., Wagenlehner, F.M., Zimmer, K.P., & Chakraborty, T., 2018. übersichtsarbeit: Therapieoptionen bei Carbapenem-resistenten gramnegativen Erregern. *Dtsch. Arztebl. Int.* 115: 345–352. doi:10.3238/arztebl.2018.0345
- García-Sureda, L., Doménech-Sánchez, A., Barbier, M., Juan, C., Gascó, J., & Albertí, S., 2011. OmpK26, a novel porin associated with carbapenem resistance in *Klebsiella pneumoniae*. *Antimicrob. Agents Chemother.* 55: 4742–4747. doi:10.1128/AAC.00309-11
- Ghazawi, A., Sonnevend, Á., Bonnin, R.A., Poirel, L., Nordmann, P., Hashmey, R., et al., 2012. NDM-2 carbapenemase-producing *Acinetobacter baumannii* in the United Arab Emirates. *Clin. Microbiol. Infect.* 18: E34–E36. doi:10.1111/j.1469-0691.2011.03726.x
- Girlich, D., Poirel, L., & Nordmann, P., 2012a. Value of the modified hodge test for detection of emerging carbapenemases in Enterobacteriaceae. *J. Clin. Microbiol.* 50: 477–479. doi:10.1128/JCM.05247-11

- Girlich, D., Poirel, L., & Nordmann, P., 2012b. Value of the modified hodge test for detection of emerging carbapenemases in Enterobacteriaceae. *J. Clin. Microbiol.* 50: 477–479. doi:10.1128/JCM.05247-11
- Gniadek, T.J., Carroll, K.C., & Simner, P.J., 2016. Carbapenem-resistant non-glucose-fermenting gram-negative bacilli: The missing piece to the puzzle. *J. Clin. Microbiol.* doi:10.1128/JCM.03264-15
- Goodman, K E, Simner, P.J., Tamma, P.D., & Milstone, A.M., 2016. Infection control implications of heterogeneous resistance mechanisms in carbapenem-resistant Enterobacteriaceae (CRE). *Expert Rev. Anti. Infect. Ther.* 14: 95–108. doi:10.1586/14787210.2016.1106940
- Goodman, K. E., Simner, P.J., Tamma, P.D., & Milstone, A.M., 2016. Infection control implications of heterogeneous resistance mechanisms in carbapenem-resistant Enterobacteriaceae (CRE). *Expert Rev. Anti. Infect. Ther.* doi:10.1586/14787210.2016.1106940
- Guh, A.Y., Bulens, S.N., Mu, Y., Jacob, J.T., Reno, J., Scott, J., et al., 2015. Epidemiology of carbapenem-resistant enterobacteriaceae in 7 US communities, 2012–2013. *JAMA - J. Am. Med. Assoc.* 314: 1479–1487. doi:10.1001/jama.2015.12480
- Herruzo, R., Ruiz, G., Vizcaino, M.J., Rivas, L., Pérez-Blanco, V., & Sanchez, M., 2017. Microbial competition in environmental nosocomial reservoirs and diffusion capacity of OXA48-Klebsiella pneumoniae: Potential impact on patients and possible control methods. *J. Prev. Med. Hyg.* 58: E34–E41. doi:10.15167/2421-4248/jpmh2017.58.1.564
- Hsu, L.Y., Apisarnthanarak, A., Khan, E., Suwantararat, N., Ghafur, A., & Tambyah, P., 2017. Carbapenem-resistant acinetobacter baumannii and enterobacteriaceae in South and Southeast Asia. *Clin. Microbiol. Rev.* doi:10.1128/CMR.00042-16
- Huang, H., Chen, B., Liu, G., Ran, J., Lian, X., Huang, X., et al., 2018. A multi-center study on the risk factors of infection caused by multi-drug resistant Acinetobacter baumannii. *BMC Infect. Dis.* 18: 11. doi:10.1186/s12879-017-2932-5
- Huang, S.T., Chiang, M.C., Kuo, S.C., Lee, Y.T., Chiang, T.H., Yang, S.P., et al., 2012. Risk factors and clinical outcomes of patients with carbapenem-resistant Acinetobacter baumannii bacteremia. *J. Microbiol. Immunol. Infect.* 45: 356–362. doi:10.1016/j.jmii.2011.12.009
- Jovanović, N., Jovanović, J., Stefan-Mikić, S., Kulauzov, M., Aleksic-Dordević, M., & Cvjetković, D., 2008. Mechanisms of bacterial resistance to antibiotics. *Med. Pregl.* 61 Suppl 1: 9–14. doi:10.1001/archinte.151.5.886
- Kieffer, N., Nordmann, P., Aires-De-Sousa, M., & Poirel, L., 2016. High prevalence of carbapenemase-producing Enterobacteriaceae among hospitalized children in Luanda, Angola. *Antimicrob. Agents Chemother.* 60: 6189–6192. doi:10.1128/AAC.01201-16
- Kim, S.Y., Jung, J.Y., Kang, Y.A., Lim, J.E., Kim, E.Y., Lee, S.K., et al., 2012. Risk factors for occurrence and 30-day mortality for carbapenem-resistant Acinetobacter baumannii bacteremia in an intensive care unit. *J. Korean Med. Sci.*

- 27: 939–947. doi:10.3346/jkms.2012.27.8.939
- Klevens, R.M., Edwards, J.R., Richards, C.L., Horan, T.C., Gaynes, R.P., Pollock, D.A., et al., 2007. Estimating health care-associated infections and deaths in U.S. Hospitals, 2002. *Public Health Rep.* 122: 160–166. doi:10.1177/003335490712200205
- Kohanski, M.A., Dwyer, D.J., & Collins, J.J., 2010. How antibiotics kill bacteria: From targets to networks. *Nat. Rev. Microbiol.* 8: 423–435. doi:10.1038/nrmicro2333
- Lagamayo, E.N., 2008. Antimicrobial resistance in major pathogens of hospital-acquired pneumonia in Asian countries. *Am. J. Infect. Control* 36: S101–S108. doi:10.1016/j.ajic.2007.10.020
- Latifah, R., 2014. Universitas Indonesia Universitas Indonesia Depok. Universitas Indonesia.
- Lauretti, L., Riccio, M.L., Mazzariol, A., Cornaglia, G., Amicosante, G., Fontana, R., et al., 1999. Cloning and characterization of bla(VIM), a new integron-borne metallo-  $\beta$ -lactamase gene from a *Pseudomonas aeruginosa* clinical isolate. *Antimicrob. Agents Chemother.* 43: 1584–1590. doi:10.1128/aac.43.7.1584
- Leclercq, R., Cantón, R., Brown, D.F.J., Giske, C.G., Heisig, P., Macgowan, A.P., et al., 2013. EUCAST expert rules in antimicrobial susceptibility testing. *Clin. Microbiol. Infect.* doi:10.1111/j.1469-0691.2011.03703.x
- Levin, A.S., Levy, C.E., Manrique, A.E.I., Medeiros, E.A.S., & Costa, S.F., 2003. Severe nosocomial infections with imipenem-resistant *Acinetobacter baumannii* treated with ampicillin/sulbactam. *Int. J. Antimicrob. Agents* 21: 58–62. doi:10.1016/S0924-8579(02)00276-5
- Li, X., & Ye, H., 2017. Clinical and mortality risk factors in bloodstream infections with carbapenem-resistant enterobacteriaceae. *Can. J. Infect. Dis. Med. Microbiol.* 2017. doi:10.1155/2017/6212910
- Lidsky, K., Huyen, C., Salvator, A., Rice, L.B., & Toltzis, P., 2002. Antibiotic-Resistant Gram-Negative Organisms in Pediatric Chronic-Care Facilities. *Clin. Infect. Dis.* 34: 760–766. doi:10.1086/338957
- Logan, L.K., Renschler, J.P., Gandra, S., Weinstein, R.A., & Laxminarayan, R., 2015. Carbapenem-resistant enterobacteriaceae in children, United States, 1999–2012. *Emerg. Infect. Dis.* 21: 2014–2021. doi:10.3201/eid2111.150548
- Lubin, E.A., Henry, J.T., Fiebig, A., Crosson, S., & Laub, M.T., 2016. Identification of the PhoB regulon and role of PhoU in the phosphate starvation response of *Caulobacter crescentus*. *J. Bacteriol.* 198: 187–200. doi:10.1128/JB.00658-15
- Mariappan, S., Sekar, U., & Kamalanathan, A., 2017. Carbapenemase-producing Enterobacteriaceae: Risk factors for infection and impact of resistance on outcomes. *Int. J. Appl. Basic Med. Res.* 7: 32. doi:10.4103/2229-516x.198520
- Mathers, A.J., Cox, H.L., Bonatti, H., Kitchel, B., Brassinga, A.K.C., Wispelwey, B., et al., 2009. Fatal cross infection by carbapenem-resistant *Klebsiella* in two liver transplant recipients. *Transpl. Infect. Dis.* 11: 257–265. doi:10.1111/j.1399-3062.2009.00374.x
- Mauldin, P.D., Salgado, C.D., Hansen, I.S., Durup, D.T., & Bosso, J.A., 2010.



- Attributable hospital cost and length of stay associated with health care-associated infections caused by antibiotic-resistant gram-negative bacteria. *Antimicrob. Agents Chemother.* 54: 109–115. doi:10.1128/AAC.01041-09
- Mayasari, E., & Siregar, C., 2014. Isolated From Clinical Specimens in Adam Malik Hospital. *Mka* 37: 1–7.
- Medlej, K., 2018. Sequential Organ Failure Assesment (SOFA) Score. *Emerg. Med. Pract.* 1–6. doi:10.1001/jama.286.14.1754
- Meletis, G., Exindari, M., Vavatsi, N., Sofianou, D., & Diza, E., 2012. Mechanisms responsible for the emergence of carbapenem resistance in *Pseudomonas aeruginosa*. *Hippokratia*.
- Mikulska, M., Viscoli, C., Orasch, C., Livermore, D.M., Averbuch, D., Cordonnier, C., et al., 2014. Aetiology and resistance in bacteraemias among adult and paediatric haematology and cancer patients. *J. Infect.* 68: 321–331. doi:10.1016/j.jinf.2013.12.006
- Miriagou, V., Cornaglia, G., Edelstein, M., Galani, I., Giske, C.G., Gniadkowski, M., et al., 2010. Acquired carbapenemases in Gram-negative bacterial pathogens: detection and surveillance issues. *Clin. Microbiol. Infect.* 16: 112–122. doi:10.1111/j.1469-0691.2009.03116.x
- Moloney, E., Lee, K.W., Craig, D., Allen, A.J., Graziadio, S., Power, M., et al., 2019. A PCR-based diagnostic testing strategy to identify carbapenemase-producing Enterobacteriaceae carriers upon admission to UK hospitals: early economic modelling to assess costs and consequences 1–9.
- Munoz-Price, L.S., Poirel, L., Bonomo, R.A., Schwaber, M.J., Daikos, G.L., Cormican, M., et al., 2013. Clinical epidemiology of the global expansion of *Klebsiella pneumoniae* carbapenemases. *Lancet Infect. Dis.* doi:10.1016/S1473-3099(13)70190-7
- Munoz-Price, L.S., & Weinstein, R.A., 2008. Acinetobacter infection. *N. Engl. J. Med.* doi:10.1056/NEJMr070741
- Naas, T., Cuzon, G., Bogaerts, P., Glupczynski, Y., & Nordmann, P., 2011. Evaluation of a DNA microarray (check-MDR CT102) for rapid detection of TEM, SHV, and CTX-M extended-spectrum  $\beta$ -lactamases and of KPC, OXA-48, VIM, IMP, and NDM-1 carbapenemases. *J. Clin. Microbiol.* 49: 1608–1613. doi:10.1128/JCM.02607-10
- Neuner, E.A., Yeh, J.Y., Hall, G.S., Sekeres, J., Endimiani, A., Bonomo, R.A., et al., 2011. Treatment and outcomes in carbapenem-resistant *Klebsiella pneumoniae* bloodstream infections. *Diagn. Microbiol. Infect. Dis.* 69: 357–362. doi:10.1016/j.diagmicrobio.2010.10.013
- Nikaido, H., 2003. Molecular Basis of Bacterial Outer Membrane Permeability Revisited. *Microbiol. Mol. Biol. Rev.* 67: 593–656. doi:10.1128/mmbr.67.4.593-656.2003
- Nordmann, P., 2014. Carbapenemase-producing Enterobacteriaceae: Overview of a major public health challenge. *Med. Mal. Infect.* doi:10.1016/j.medmal.2013.11.007

- Nordmann, P., Naas, T., & Poirel, L., 2011a. Global spread of carbapenemase producing Enterobacteriaceae. *Emerg. Infect. Dis.* 17: 1791–1798. doi:10.3201/eid1710.110655
- Nordmann, P., Naas, T., & Poirel, L., 2011b. Global spread of carbapenemase producing Enterobacteriaceae. *Emerg. Infect. Dis.* 17: 1791–1798. doi:10.3201/eid1710.110655
- Nordmann, P., Poirel, L., & Dortet, L., 2012. Rapid detection of carbapenemase-producing enterobacteriaceae. *Emerg. Infect. Dis.* 18: 1503–1507. doi:10.3201/eid1809.120355
- Nurmala, N., Virgiandhy, I., Andriani, A., & Liana, D.F., 2015. Resistensi dan Sensitivitas Bakteri terhadap Antibiotik di RSUD dr. Soedarso Pontianak Tahun 2011-2013. *eJournal Kedokt. Indones.* 3. doi:10.23886/ejki.3.4803.
- Oviaño, M., Barba, M.J., Fernández, B., Ortega, A., Aracil, B., Oteo, J., et al., 2016. Rapid Detection of OXA-48-Producing Enterobacteriaceae by Matrix-Assisted Laser Desorption Ionization Time of Flight Mass Spectrometry. *J. Clin. Microbiol.* 54: 754–759. doi:10.1128/JCM.02496-15
- Papagiannitsis, C.C., Študentová, V., Izdebski, R., Oikonomou, O., Pfeifer, Y., Petinaki, E., et al., 2015. Matrix-assisted laser desorption ionization-time of flight mass spectrometry meropenem hydrolysis assay with NH<sub>4</sub>HCO<sub>3</sub>, a reliable tool for direct detection of carbapenemase activity. *J. Clin. Microbiol.* 53: 1731–1735. doi:10.1128/JCM.03094-14
- Papp-Wallace, K.M., Endimiani, A., Taracila, M.A., & Bonomo, R.A., 2011. Carbapenems: Past, present, and future. *Antimicrob. Agents Chemother.* 55: 4943–4960. doi:10.1128/AAC.00296-11
- Papst, L., Beović, B., Pulcini, C., Durante-Mangoni, E., Rodríguez-Baño, J., Kaye, K.S., et al., 2018. Antibiotic treatment of infections caused by carbapenem-resistant Gram-negative bacilli: an international ESCMID cross-sectional survey among infectious diseases specialists practicing in large hospitals. *Clin. Microbiol. Infect.* 24: 1070–1076. doi:10.1016/j.cmi.2018.01.015
- Paraton, H., 2018. Program pengendalian resistensi antimikroba di indonesia hasil capaian dan target ke depan.
- Peirano, G., Schreckenberger, P.C., & Pitout, J.D.D., 2011. Characteristics of NDM-1-Producing Escherichia coli Isolates That Belong to the Successful and Virulent Clone ST131. *Antimicrob. Agents Chemother.* 55: 2986–2988. doi:10.1128/AAC.01763-10
- Peleg, A.Y., & Hooper, D.C., 2010. Hospital-acquired infections due to gram-negative bacteria. *N. Engl. J. Med.* doi:10.1056/NEJMra0904124
- Perez, K.K., Olsen, R.J., Musick, W.L., Cernoch, P.L., Davis, J.R., Land, G.A., et al., 2013. Integrating rapid pathogen identification and antimicrobial stewardship significantly decreases hospital costs. *Arch. Pathol. Lab. Med.* 137: 1247–1254. doi:10.5858/arpa.2012-0651-OA
- Poirel, L., Naas, T., Nicolas, D., Collet, L., Bellais, S., Cavallo, J.D., et al., 2000. Characterization of VIM-2, a carbapenem-hydrolyzing metallo-β-lactamase and

- its plasmid- and integron-borne gene from a *Pseudomonas aeruginosa* clinical isolate in France. *Antimicrob. Agents Chemother.* 44: 891–897. doi:10.1128/AAC.44.4.891-897.2000
- Poirel, L., Pitout, J.D., & Nordmann, P., 2007a. Carbapenemases: Molecular diversity and clinical consequences. *Future Microbiol.* doi:10.2217/17460913.2.5.501
- Poirel, L., Pitout, J.D., & Nordmann, P., 2007b. Carbapenemases: Molecular diversity and clinical consequences. *Future Microbiol.* doi:10.2217/17460913.2.5.501
- Potron, A., Poirel, L., & Nordmann, P., 2014. Derepressed transfer properties leading to the efficient spread of the plasmid encoding carbapenemase OXA-48. *Antimicrob. Agents Chemother.* 58: 467–471. doi:10.1128/AAC.01344-13
- Queenan, A.M., & Bush, K., 2007. Carbapenemases: The versatile  $\beta$ -lactamases. *Clin. Microbiol. Rev.* 20: 440–458. doi:10.1128/CMR.00001-07
- Rahman, A., 2018. Carbapenem-Resistant Enterobacteriaceae: Clinico-Epidemiological Perspective, Tropical Biomedicine.
- Rasmussen, B.A., Bush, K., Keeney, D., Yang, Y., Hare, R., O’Gara, C., et al., 1996. Characterization of IMI-1  $\beta$ -lactamase, a class a carbapenem- hydrolyzing enzyme from *Enterobacter cloacae*. *Antimicrob. Agents Chemother.* 40: 2080–2086. doi:10.1128/aac.40.9.2080
- RINI LATIFAH Indonesia, U., 2014. Deteksi Enzim Karbapenemase dan Gen Pengkodanya pada Isolat *Pseudomonas aeruginosa* dan *Acinetobacter baumannii* Resisten Karbapenem di ICU-RSUPN CiptoMangunkusumo tahun 2011. UNIVERSITAS INDONESIA Deteksi.
- Sabino, Y.N.V., Santana, M.F., Oyama, L.B., Santos, F.G., Moreira, A.J.S., Huws, S.A., et al., 2019. Characterization of antibiotic resistance genes in the species of the rumen microbiota. *Nat. Commun.* 10: 1–11. doi:10.1038/s41467-019-13118-0
- Samanta, I., & Bandyopadhyay, S., 2020. Carbapenem resistance. *Antimicrob. Resist. Agric.* 59–69. doi:10.1016/b978-0-12-815770-1.00007-9
- Scott, D., 2015. The Mechanics of Antibiotic Resistance. *Amaz. Sci.* 1–18.
- Shortell, S.M., Zimmerman, J.E., Rousseau, D.M., Gillies, R.R., Wagner, D.P., Draper, E.A., et al., 1994. The performance of intensive care units: Does good management make a difference? *Med. Care* 32: 508–525. doi:10.1097/00005650-199405000-00009
- Singer, M., Deutschman, C.S., Seymour, C., Shankar-Hari, M., Annane, D., Bauer, M., et al., 2016. The third international consensus definitions for sepsis and septic shock (sepsis-3). *JAMA - J. Am. Med. Assoc.* doi:10.1001/jama.2016.0287
- Srinivasan, A., & Patel, J.B., 2008. *Klebsiella pneumoniae* Carbapenemase–Producing Organisms: An Ounce of Prevention Really Is Worth a Pound of Cure . *Infect. Control Hosp. Epidemiol.* 29: 1107–1109. doi:10.1086/594129
- Suharti, R.R.N., 2012. Dan identifikasi, DETEKSI DAN IDENTIFIKASI ENZIM METALLO- BETA IACTAMASE (MBL) PADA BAKTERI PATOGEN YANG RESISTEN TERHADAP ANTIBIOTIKA CARBAPENEM.
- Sumita, Y., & Fakasawa, M., 1995. Potent activity of meropenem against *Escherichia*



- coli arising from its simultaneous binding to penicillin-binding proteins 2 and 3. *J. Antimicrob. Chemother.* 36: 53–64. doi:10.1093/jac/36.1.53
- Tacconelli, E; Magrini, N., 2017. WHO | Global priority list of antibiotic-resistant bacteria to guide research, discovery, and development of new antibiotics. *Who*.
- Tamma, P.D., Opene, B.N.A., Gluck, A., Chambers, K.K., Karen C. Carroll, & Simner, P.J., 2017. Comparison of 11 Phenotypic Assays for Accurate Detection of Carbapenemase- Producing Enterobacteriaceae. *J. Clin. Microbiol.* 55: 1046–1055.
- Tamma, P.D., & Simner, P.J., 2018a. Phenotypic Detection of Carbapenemase-Producing Organisms from Clinical Isolates. *J. Clin. Microbiol.* 56.
- Tamma, P.D., & Simner, P.J., 2018b. Phenotypic detection of carbapenemase-producing organisms from clinical isolates. *J. Clin. Microbiol.* 56: 1–13. doi:10.1128/JCM.01140-18
- Tamma, P.D., & Simner, P.J., 2018c. Phenotypic detection of carbapenemase-producing organisms from clinical isolates. *J. Clin. Microbiol.* doi:10.1128/JCM.01140-18
- Thaden, J.T., Pogue, J.M., & Kaye, K.S., 2017. Role of newer and re-emerging older agents in the treatment of infections caused by carbapenem-resistant Enterobacteriaceae. *Virulence*. doi:10.1080/21505594.2016.1207834
- Thomson, G., Turner, D., Brasso, W., Kircher, S., Guillet, T., & Thomson, K., 2017. High-stringency evaluation of the automated BD phoenix CPO detect and rapidec carba NP tests for detection and classification of carbapenemases. *J. Clin. Microbiol.* 55: 3437–3443. doi:10.1128/JCM.01215-17
- Tsakris, A., Poulou, A., Bogaerts, P., Dimitroulia, E., Pournaras, S., & Glupczynski, Y., 2015. Evaluation of a new phenotypic OXA-48 disk test for differentiation of OXA-48 carbapenemase-producing Enterobacteriaceae clinical isolates. *J. Clin. Microbiol.* 53: 1245–1251. doi:10.1128/JCM.03318-14
- Tzouveleakis, L.S., Markogiannakis, A., Psychogiou, M., Tassios, P.T., & Daikos, G.L., 2012. Carbapenemases in *Klebsiella pneumoniae* and other Enterobacteriaceae: An evolving crisis of global dimensions. *Clin. Microbiol. Rev.* 25: 682–707. doi:10.1128/CMR.05035-11
- van Dam, V., Olrichs, N., & Breukink, E., 2009. Specific labeling of peptidoglycan precursors as a tool for bacterial cell wall studies. *ChemBioChem*. doi:10.1002/cbic.200800678
- van Duin, D., Cober, E.D., Richter, S.S., Perez, F., Cline, M., Kaye, K.S., et al., 2014. Tigecycline therapy for carbapenem-resistant *Klebsiella pneumoniae* (CRKP) bacteriuria leads to tigecycline resistance. *Clin. Microbiol. Infect.* 20: O1117–O1120. doi:10.1111/1469-0691.12714
- Váradi, L., Luo, J.L., Hibbs, D.E., Perry, J.D., Anderson, R.J., Orena, S., et al., 2017. Methods for the detection and identification of pathogenic bacteria: Past, present, and future. *Chem. Soc. Rev.* doi:10.1039/c6cs00693k
- Vardakas, K.Z., Matthaiou, D.K., Falagas, M.E., Antypa, E., Koteli, A., & Antoniadou, E., 2015. Characteristics, risk factors and outcomes of carbapenem-resistant

- Klebsiella pneumoniae infections in the intensive care unit. *J. Infect.* 70: 592–599. doi:10.1016/j.jinf.2014.11.003
- Ventola, C.L., 2015. The antibiotic resistance crisis: causes and threats. *P T J.* 40: 277–283. doi:Article
- Verma, N., Prahraj, A., Mishra, B., Behera, B., & Gupta, K., 2019. Detection of carbapenemase-producing *Pseudomonas aeruginosa* by phenotypic and genotypic methods in a tertiary care hospital of East India. *J. Lab. Physicians* 11: 287–291. doi:10.4103/jlp.jlp\_136\_19
- Viale, P., Giannella, M., Lewis, R., Trecarichi, E.M., Petrosillo, N., & Tumbarello, M., 2013. Predictors of mortality in multidrug-resistant *Klebsiella pneumoniae* bloodstream infections. *Expert Rev. Anti. Infect. Ther.* doi:10.1586/14787210.2013.836057
- Villegas, M.V., Pallares, C.J., Escandón-Vargas, K., Hernández-Gómez, C., Correa, A., Álvarez, C., et al., 2016. Characterization and clinical impact of bloodstream infection caused by carbapenemase-producing enterobacteriaceae in seven Latin American countries. *PLoS One* 11. doi:10.1371/journal.pone.0154092
- Vincent, J.L., Moreno, R., Takala, J., Willatts, S., De Mendonça, A., Bruining, H., et al., 1996. The SOFA (Sepsis-related Organ Failure Assessment) score to describe organ dysfunction/failure. *Intensive Care Med.* 22: 707–710. doi:10.1007/BF01709751
- Walsh, T.R., 2010. Emerging carbapenemases: A global perspective. *Int. J. Antimicrob. Agents* 36: S8. doi:10.1016/S0924-8579(10)70004-2
- Walsh, T.R., Toleman, M.A., Poirel, L., & Nordmann, P., 2005. Metallo- $\beta$ -lactamases: The quiet before the storm? *Clin. Microbiol. Rev.* doi:10.1128/CMR.18.2.306-325.2005
- Wang, W., Arshad, M.I., Khurshid, M., Rasool, M.H., Nisar, M.A., Aslam, M.A., et al., 2018. Antibiotic resistance : a rundown of a global crisis. *Infect. Drug Resist.* 1645–1658.
- Williamson, D.A., Sidjabat, H.E., Freeman, J.T., Roberts, S.A., Silvey, A., Woodhouse, R., et al., 2012. Identification and molecular characterisation of New Delhi metallo- $\beta$ -lactamase-1 (NDM-1)- and NDM-6-producing Enterobacteriaceae from New Zealand hospitals, in: *International Journal of Antimicrobial Agents*. pp. 529–533. doi:10.1016/j.ijantimicag.2012.02.017
- Woodford, N., Tierno, P.M., Young, K., Tysall, L., Palepou, M.F.I., Ward, E., et al., 2004. Outbreak of *Klebsiella pneumoniae* producing a new carbapenem-hydrolyzing class A  $\beta$ -lactamase, KPC-3, in a New York Medical Center. *Antimicrob. Agents Chemother.* 48: 4793–4799. doi:10.1128/AAC.48.12.4793-4799.2004
- Zarkotou, O., Pournaras, S., Tselioti, P., Dragoumanos, V., Pitiriga, V., Ranellou, K., et al., 2011. Predictors of mortality in patients with bloodstream infections caused by KPC-producing *Klebsiella pneumoniae* and impact of appropriate antimicrobial treatment. *Clin. Microbiol. Infect.* 17: 1798–1803. doi:10.1111/j.1469-0691.2011.03514.x

- Zhanel, G.G., Wiebe, R., Dilay, L., Thomson, K., Rubinstein, E., Hoban, D.J., et al., 2007. Comparative review of the carbapenems. *Drugs* 67: 1027–1052. doi:10.2165/00003495-200767070-00006
- Zwaluw, K. Van Der, Haan, A. De, Pluister, G.N., & Bootsma, H.J., 2015. The Carbapenem Inactivation Method ( CIM ), a Simple and Low-Cost Alternative for the Carba NP Test to Assess Phenotypic Carbapenemase Activity in Gram-Negative Rods 1–13. doi:10.1371/journal.pone.0123690
- Abbott, I., Cerqueira, G.M., Bhuiyan, S., & Peleg, A.Y., 2013. Carbapenem resistance in *Acinetobacter baumannii*: Laboratory challenges, mechanistic insights and therapeutic strategies. *Expert Rev. Anti. Infect. Ther.* doi:10.1586/eri.13.21
- Abdelaziz, M.O., Bonura, C., Aleo, A., Fasciana, T., & Mammina, C., 2013. NDM-1- and OXA-163-producing *Klebsiella pneumoniae* isolates in Cairo, Egypt, 2012. *J. Glob. Antimicrob. Resist.* 1: 213–215. doi:10.1016/j.jgar.2013.06.003
- Ambler, R.P., 1980a. The structure of  $\beta$ -lactamases. *Philos. Trans. R. Soc. London. B, Biol. Sci.* 289: 321–331. doi:10.1098/rstb.1980.0049
- Ambler, R.P., 1980b. The structure of beta-lactamases. *Philos. Trans. R. Soc. Lond. B. Biol. Sci.* 289: 321–331. doi:10.1098/rstb.1980.0049
- Anderson, K.F., Lonsway, D.R., Rasheed, J.K., Biddle, J., Jensen, B., McDougal, L.K., et al., 2007. Evaluation of methods to identify the *Klebsiella pneumoniae* carbapenemase in Enterobacteriaceae. *J. Clin. Microbiol.* 45: 2723–2725. doi:10.1128/JCM.00015-07
- Aygun, F., Aygun, F.D., Varol, F., Durak, C., Çokuğraş, H., Camcıoğlu, Y., et al., 2019. Infections with carbapenem-resistant gram-negative bacteria are a serious problem among critically ill children: A single-centre retrospective study. *Pathogens* 8. doi:10.3390/pathogens8020069
- Baquero, F., 2001. Low-level antibacterial resistance: A gateway to clinical resistance. *Drug Resist. Updat.* doi:10.1054/drup.2001.0196
- Baughman, R.P., 2009. The use of carbapenems in the treatment of serious infections. *J. Intensive Care Med.* doi:10.1177/0885066609335660
- Ben-David, D., Maor, Y., Keller, N., Regev-Yochay, G., Tal, I., Shachar, D., et al., 2010. Potential Role of Active Surveillance in the Control of a Hospital-Wide Outbreak of Carbapenem-Resistant *Klebsiella pneumoniae* Infection . *Infect. Control Hosp. Epidemiol.* 31: 620–626. doi:10.1086/652528
- Ben-David, D., Masarwa, S., Navon-Venezia, S., Mishali, H., Fridental, I., Rubinovitch, B., et al., 2011. Carbapenem-Resistant *Klebsiella pneumoniae* in Post-Acute-Care Facilities in Israel . *Infect. Control Hosp. Epidemiol.* 32: 845–853. doi:10.1086/661279
- Bielicki, J.A., Cromwell, D.A., Johnson, A., Planche, T., & Sharland, M., 2017. Surveillance of Gram-negative bacteria: impact of variation in current European laboratory reporting practice on apparent multidrug resistance prevalence in paediatric bloodstream isolates. *Eur. J. Clin. Microbiol. Infect. Dis.* 36: 839–846. doi:10.1007/s10096-016-2869-4

- Bone, R.C., Balk, R.A., Cerra, F.B., Dellinger, R.P., Fein, A.M., Knaus, W.A., et al., 1992. Definitions for sepsis and organ failure and guidelines for the use of innovative therapies in sepsis, in: *Chest*. *Chest*, pp. 1644–1655. doi:10.1378/chest.101.6.1644
- Bonomo, R.A., Burd, E.M., Conly, J., Limbago, B.M., Poirel, L., Segre, J.A., et al., 2018. Carbapenemase-Producing Organisms: A Global Scourge. *Clin. Infect. Dis.* doi:10.1093/cid/cix893
- Bonomo, R.A., & Szabo, D., 2006. Mechanisms of multidrug resistance in *Acinetobacter* species and *Pseudomonas aeruginosa*, in: *Clinical Infectious Diseases*. doi:10.1086/504477
- Boutal, H., Vogel, A., Bernabeu, S., Devilliers, K., Creton, E., Cotellon, G., et al., 2018. A multiplex lateral flow immunoassay for the rapid identification of NDM-, KPC-, IMP- and VIM-type and OXA-48-like carbapenemase-producing Enterobacteriaceae. *J. Antimicrob. Chemother.* doi:10.1093/jac/dkx521
- Brink, A.J., 2019. Epidemiology of carbapenem-resistant Gram-negative infections globally. *Curr. Opin. Infect. Dis.* 609–616. doi:10.1097/QCO.0000000000000608
- Capone, A., Giannella, M., Fortini, D., Giordano, A., Meledandri, M., Ballardini, M., et al., 2013. High rate of colistin resistance among patients with carbapenem-resistant *Klebsiella pneumoniae* infection accounts for an excess of mortality. *Clin. Microbiol. Infect.* 19. doi:10.1111/1469-0691.12070
- Carvalhoes, C.G., Picão, R.C., Nicoletti, A.G., Xavier, D.E., & Gales, A.C., 2009. Cloverleaf test (modified Hodge test) for detecting carbapenemase production in *Klebsiella pneumoniae*: be aware of false positive results. *J. Antimicrob. Chemother.* 65: 249–251. doi:10.1093/jac/dkp431
- Caselli, D., Cesaro, S., Fagioli, F., Carraro, F., Ziino, O., Zanazzo, G., et al., n.d. Pediatric Hematology Oncology, Trieste, 6 Pediatric Oncology Unit. *Fond. IRCCS Ist. Naz. Tumori*. doi:10.3109/23744235.2015.1087647
- Cienfuegos-Gallet, A. V., Ocampo De Los Ríos, A.M., Sierra Viana, P., Ramirez Brinez, F., Restrepo Castro, C., Roncancio Villamil, G., et al., 2019. Risk factors and survival of patients infected with carbapenem-resistant *Klebsiella pneumoniae* in a KPC endemic setting: A case-control and cohort study. *BMC Infect. Dis.* 19: 830. doi:10.1186/s12879-019-4461-x
- Cleven, B.E.E., Palka-Santini, M., Gielen, J., Meembor, S., Krönke, M., & Krut, O., 2006. Identification and characterization of bacterial pathogens causing bloodstream infections by DNA microarray. *J. Clin. Microbiol.* 44: 2389–2397. doi:10.1128/JCM.02291-05
- Codjoe, F., & Donkor, E., 2017. Carbapenem Resistance: A Review. *Med. Sci.* 6: 1. doi:10.3390/medsci6010001
- Dahesih, D., Dewi, Y.P., Sugainli, A.K., & Parwati, I., 2019. SURVEILANS BAKTERI RESISTAN MULTI OBAT dan KEPEKAANNYA TERHADAP ANTIBIOTIK di RUMAH SAKIT INDONESIA TAHUN 2018.
- Daikos, G.L., Petrikos, P., Psychogiou, M., Kosmidis, C., Vryonis, E., Skoutelis, A., et al., 2009. Prospective observational study of the impact of VIM-1 metallo- $\beta$ -

- lactamase on the outcome of patients with *Klebsiella pneumoniae* bloodstream infections. *Antimicrob. Agents Chemother.* 53: 1868–1873. doi:10.1128/AAC.00782-08
- Dautzenberg, M.J., Ossewaarde, J.M., de Kraker, M.E., van der Zee, A., van Burgh, S., de Greeff, S.C., et al., 2014. Successful control of a hospital-wide outbreak of OXA-48 producing enterobacteriaceae in the Netherlands, 2009 to 2011. *Eurosurveillance* 19. doi:10.2807/1560-7917.ES2014.19.9.20723
- Djordjevic, Z.M., Folic, M.M., Folic, N.D., Gajovic, N., Gajovic, O., & Jankovic, S.M., 2016. Risk factors for hospital infections caused by carbapenem-resistant *Acinetobacter baumannii*. *J. Infect. Dev. Ctries.* 10: 1073–1080. doi:10.3855/jidc.8231
- Dortet, L., Bréchard, L., Poirel, L., & Nordmann, P., 2014. Rapid detection of carbapenemase-producing Enterobacteriaceae from blood cultures. *Clin. Microbiol. Infect.* 20: 340–344. doi:10.1111/1469-0691.12318
- Dortet, L., Jousset, A., Sainte-Rose, V., Cuzon, G., & Naas, T., 2016. Prospective evaluation of the OXA-48 K-SeT assay, an immunochromatographic test for the rapid detection of OXA-48-type carbapenemases. *J. Antimicrob. Chemother.* 71: 1834–1840. doi:10.1093/jac/dkw058
- Dortet, Laurent, Poirel, L., & Nordmann, P., 2014. Worldwide dissemination of the NDM-Type carbapenemases in Gram-negative bacteria. *Biomed Res. Int.* 2014. doi:10.1155/2014/249856
- Falagas, M.E., Tansarli, G.S., Karageorgopoulos, D.E., & Vardakas, K.Z., 2014. Deaths attributable to carbapenem-resistant enterobacteriaceae infections. *Emerg. Infect. Dis.* 20: 1170–1175. doi:10.3201/eid2007.121004
- Fernández, L., & Hancock, R.E.W., 2012. Adaptive and Mutational Resistance : Role of Porins and Efflux Pumps in Drug Resistance 25: 661–681. doi:10.1128/CMR.00043-12
- Ferreira, F.L., 2001. Serial Evaluation of the SOFA Score 286.
- Fritzenwanker, M., Imirzalioglu, C., Herold, S., Wagenlehner, F.M., Zimmer, K.P., & Chakraborty, T., 2018. übersichtsarbeit: Therapieoptionen bei Carbapenem-resistenten gramnegativen Erregern. *Dtsch. Arztebl. Int.* 115: 345–352. doi:10.3238/arztebl.2018.0345
- García-Sureda, L., Doménech-Sánchez, A., Barbier, M., Juan, C., Gascó, J., & Albertí, S., 2011. OmpK26, a novel porin associated with carbapenem resistance in *Klebsiella pneumoniae*. *Antimicrob. Agents Chemother.* 55: 4742–4747. doi:10.1128/AAC.00309-11
- Ghazawi, A., Sonnevend, Á., Bonnin, R.A., Poirel, L., Nordmann, P., Hashmey, R., et al., 2012. NDM-2 carbapenemase-producing *Acinetobacter baumannii* in the United Arab Emirates. *Clin. Microbiol. Infect.* 18: E34–E36. doi:10.1111/j.1469-0691.2011.03726.x
- Girlich, D., Poirel, L., & Nordmann, P., 2012a. Value of the modified hodge test for detection of emerging carbapenemases in Enterobacteriaceae. *J. Clin. Microbiol.* 50: 477–479. doi:10.1128/JCM.05247-11



- Girlich, D., Poirel, L., & Nordmann, P., 2012b. Value of the modified hodge test for detection of emerging carbapenemases in Enterobacteriaceae. *J. Clin. Microbiol.* 50: 477–479. doi:10.1128/JCM.05247-11
- Gniadek, T.J., Carroll, K.C., & Simner, P.J., 2016. Carbapenem-resistant non-glucose-fermenting gram-negative bacilli: The missing piece to the puzzle. *J. Clin. Microbiol.* doi:10.1128/JCM.03264-15
- Goodman, K E, Simner, P.J., Tamma, P.D., & Milstone, A.M., 2016. Infection control implications of heterogeneous resistance mechanisms in carbapenem-resistant Enterobacteriaceae (CRE). *Expert Rev. Anti. Infect. Ther.* 14: 95–108. doi:10.1586/14787210.2016.1106940
- Goodman, K. E., Simner, P.J., Tamma, P.D., & Milstone, A.M., 2016. Infection control implications of heterogeneous resistance mechanisms in carbapenem-resistant Enterobacteriaceae (CRE). *Expert Rev. Anti. Infect. Ther.* doi:10.1586/14787210.2016.1106940
- Guh, A.Y., Bulens, S.N., Mu, Y., Jacob, J.T., Reno, J., Scott, J., et al., 2015. Epidemiology of carbapenem-resistant enterobacteriaceae in 7 US communities, 2012–2013. *JAMA - J. Am. Med. Assoc.* 314: 1479–1487. doi:10.1001/jama.2015.12480
- Herruzo, R., Ruiz, G., Vizcaino, M.J., Rivas, L., Pérez-Blanco, V., & Sanchez, M., 2017. Microbial competition in environmental nosocomial reservoirs and diffusion capacity of OXA48-Klebsiella pneumoniae: Potential impact on patients and possible control methods. *J. Prev. Med. Hyg.* 58: E34–E41. doi:10.15167/2421-4248/jpmh2017.58.1.564
- Hsu, L.Y., Apisarnthanarak, A., Khan, E., Suwantararat, N., Ghafur, A., & Tambyah, P., 2017. Carbapenem-resistant acinetobacter baumannii and enterobacteriaceae in South and Southeast Asia. *Clin. Microbiol. Rev.* doi:10.1128/CMR.00042-16
- Huang, H., Chen, B., Liu, G., Ran, J., Lian, X., Huang, X., et al., 2018. A multi-center study on the risk factors of infection caused by multi-drug resistant Acinetobacter baumannii. *BMC Infect. Dis.* 18: 11. doi:10.1186/s12879-017-2932-5
- Huang, S.T., Chiang, M.C., Kuo, S.C., Lee, Y.T., Chiang, T.H., Yang, S.P., et al., 2012. Risk factors and clinical outcomes of patients with carbapenem-resistant Acinetobacter baumannii bacteremia. *J. Microbiol. Immunol. Infect.* 45: 356–362. doi:10.1016/j.jmii.2011.12.009
- Jovanović, N., Jovanović, J., Stefan-Mikić, S., Kulauzov, M., Aleksic-Dordević, M., & Cvjetković, D., 2008. Mechanisms of bacterial resistance to antibiotics. *Med. Pregl.* 61 Suppl 1: 9–14. doi:10.1001/archinte.151.5.886
- Kieffer, N., Nordmann, P., Aires-De-Sousa, M., & Poirel, L., 2016. High prevalence of carbapenemase-producing Enterobacteriaceae among hospitalized children in Luanda, Angola. *Antimicrob. Agents Chemother.* 60: 6189–6192. doi:10.1128/AAC.01201-16
- Kim, S.Y., Jung, J.Y., Kang, Y.A., Lim, J.E., Kim, E.Y., Lee, S.K., et al., 2012. Risk factors for occurrence and 30-day mortality for carbapenem-resistant Acinetobacter baumannii bacteremia in an intensive care unit. *J. Korean Med. Sci.*

- 27: 939–947. doi:10.3346/jkms.2012.27.8.939
- Klevens, R.M., Edwards, J.R., Richards, C.L., Horan, T.C., Gaynes, R.P., Pollock, D.A., et al., 2007. Estimating health care-associated infections and deaths in U.S. Hospitals, 2002. *Public Health Rep.* 122: 160–166. doi:10.1177/003335490712200205
- Kohanski, M.A., Dwyer, D.J., & Collins, J.J., 2010. How antibiotics kill bacteria: From targets to networks. *Nat. Rev. Microbiol.* 8: 423–435. doi:10.1038/nrmicro2333
- Lagamayo, E.N., 2008. Antimicrobial resistance in major pathogens of hospital-acquired pneumonia in Asian countries. *Am. J. Infect. Control* 36: S101–S108. doi:10.1016/j.ajic.2007.10.020
- Latifah, R., 2014. Universitas Indonesia Universitas Indonesia Depok. Universitas Indonesia.
- Lauretti, L., Riccio, M.L., Mazzariol, A., Cornaglia, G., Amicosante, G., Fontana, R., et al., 1999. Cloning and characterization of bla(VIM), a new integron-borne metallo-  $\beta$ -lactamase gene from a *Pseudomonas aeruginosa* clinical isolate. *Antimicrob. Agents Chemother.* 43: 1584–1590. doi:10.1128/aac.43.7.1584
- Leclercq, R., Cantón, R., Brown, D.F.J., Giske, C.G., Heisig, P., Macgowan, A.P., et al., 2013. EUCAST expert rules in antimicrobial susceptibility testing. *Clin. Microbiol. Infect.* doi:10.1111/j.1469-0691.2011.03703.x
- Levin, A.S., Levy, C.E., Manrique, A.E.I., Medeiros, E.A.S., & Costa, S.F., 2003. Severe nosocomial infections with imipenem-resistant *Acinetobacter baumannii* treated with ampicillin/sulbactam. *Int. J. Antimicrob. Agents* 21: 58–62. doi:10.1016/S0924-8579(02)00276-5
- Li, X., & Ye, H., 2017. Clinical and mortality risk factors in bloodstream infections with carbapenem-resistant enterobacteriaceae. *Can. J. Infect. Dis. Med. Microbiol.* 2017. doi:10.1155/2017/6212910
- Lidsky, K., Huyen, C., Salvator, A., Rice, L.B., & Toltzis, P., 2002. Antibiotic-Resistant Gram-Negative Organisms in Pediatric Chronic-Care Facilities. *Clin. Infect. Dis.* 34: 760–766. doi:10.1086/338957
- Logan, L.K., Renschler, J.P., Gandra, S., Weinstein, R.A., & Laxminarayan, R., 2015. Carbapenem-resistant enterobacteriaceae in children, United States, 1999–2012. *Emerg. Infect. Dis.* 21: 2014–2021. doi:10.3201/eid2111.150548
- Lubin, E.A., Henry, J.T., Fiebig, A., Crosson, S., & Laub, M.T., 2016. Identification of the PhoB regulon and role of PhoU in the phosphate starvation response of *Caulobacter crescentus*. *J. Bacteriol.* 198: 187–200. doi:10.1128/JB.00658-15
- Mariappan, S., Sekar, U., & Kamalanathan, A., 2017. Carbapenemase-producing Enterobacteriaceae: Risk factors for infection and impact of resistance on outcomes. *Int. J. Appl. Basic Med. Res.* 7: 32. doi:10.4103/2229-516x.198520
- Mathers, A.J., Cox, H.L., Bonatti, H., Kitchel, B., Brassinga, A.K.C., Wispelwey, B., et al., 2009. Fatal cross infection by carbapenem-resistant *Klebsiella* in two liver transplant recipients. *Transpl. Infect. Dis.* 11: 257–265. doi:10.1111/j.1399-3062.2009.00374.x
- Mauldin, P.D., Salgado, C.D., Hansen, I.S., Durup, D.T., & Bosso, J.A., 2010.

- Attributable hospital cost and length of stay associated with health care-associated infections caused by antibiotic-resistant gram-negative bacteria. *Antimicrob. Agents Chemother.* 54: 109–115. doi:10.1128/AAC.01041-09
- Mayasari, E., & Siregar, C., 2014. Isolated From Clinical Specimens in Adam Malik Hospital. *Mka* 37: 1–7.
- Medlej, K., 2018. Sequential Organ Failure Assesment (SOFA) Score. *Emerg. Med. Pract.* 1–6. doi:10.1001/jama.286.14.1754
- Meletis, G., Exindari, M., Vavatsi, N., Sofianou, D., & Diza, E., 2012. Mechanisms responsible for the emergence of carbapenem resistance in *Pseudomonas aeruginosa*. *Hippokratia*.
- Mikulska, M., Viscoli, C., Orasch, C., Livermore, D.M., Averbuch, D., Cordonnier, C., et al., 2014. Aetiology and resistance in bacteraemias among adult and paediatric haematology and cancer patients. *J. Infect.* 68: 321–331. doi:10.1016/j.jinf.2013.12.006
- Miriagou, V., Cornaglia, G., Edelstein, M., Galani, I., Giske, C.G., Gniadkowski, M., et al., 2010. Acquired carbapenemases in Gram-negative bacterial pathogens: detection and surveillance issues. *Clin. Microbiol. Infect.* 16: 112–122. doi:10.1111/j.1469-0691.2009.03116.x
- Moloney, E., Lee, K.W., Craig, D., Allen, A.J., Graziadio, S., Power, M., et al., 2019. A PCR-based diagnostic testing strategy to identify carbapenemase-producing Enterobacteriaceae carriers upon admission to UK hospitals: early economic modelling to assess costs and consequences 1–9.
- Munoz-Price, L.S., Poirel, L., Bonomo, R.A., Schwaber, M.J., Daikos, G.L., Cormican, M., et al., 2013. Clinical epidemiology of the global expansion of *Klebsiella pneumoniae* carbapenemases. *Lancet Infect. Dis.* doi:10.1016/S1473-3099(13)70190-7
- Munoz-Price, L.S., & Weinstein, R.A., 2008. Acinetobacter infection. *N. Engl. J. Med.* doi:10.1056/NEJMr070741
- Naas, T., Cuzon, G., Bogaerts, P., Glupczynski, Y., & Nordmann, P., 2011. Evaluation of a DNA microarray (check-MDR CT102) for rapid detection of TEM, SHV, and CTX-M extended-spectrum  $\beta$ -lactamases and of KPC, OXA-48, VIM, IMP, and NDM-1 carbapenemases. *J. Clin. Microbiol.* 49: 1608–1613. doi:10.1128/JCM.02607-10
- Neuner, E.A., Yeh, J.Y., Hall, G.S., Sekeres, J., Endimiani, A., Bonomo, R.A., et al., 2011. Treatment and outcomes in carbapenem-resistant *Klebsiella pneumoniae* bloodstream infections. *Diagn. Microbiol. Infect. Dis.* 69: 357–362. doi:10.1016/j.diagmicrobio.2010.10.013
- Nikaido, H., 2003. Molecular Basis of Bacterial Outer Membrane Permeability Revisited. *Microbiol. Mol. Biol. Rev.* 67: 593–656. doi:10.1128/mmbr.67.4.593-656.2003
- Nordmann, P., 2014. Carbapenemase-producing Enterobacteriaceae: Overview of a major public health challenge. *Med. Mal. Infect.* doi:10.1016/j.medmal.2013.11.007

- Nordmann, P., Naas, T., & Poirel, L., 2011a. Global spread of carbapenemase producing Enterobacteriaceae. *Emerg. Infect. Dis.* 17: 1791–1798. doi:10.3201/eid1710.110655
- Nordmann, P., Naas, T., & Poirel, L., 2011b. Global spread of carbapenemase producing Enterobacteriaceae. *Emerg. Infect. Dis.* 17: 1791–1798. doi:10.3201/eid1710.110655
- Nordmann, P., Poirel, L., & Dortet, L., 2012. Rapid detection of carbapenemase-producing enterobacteriaceae. *Emerg. Infect. Dis.* 18: 1503–1507. doi:10.3201/eid1809.120355
- Nurmala, N., Virgiandhy, I., Andriani, A., & Liana, D.F., 2015. Resistensi dan Sensitivitas Bakteri terhadap Antibiotik di RSUD dr. Soedarso Pontianak Tahun 2011-2013. *eJournal Kedokt. Indones.* 3. doi:10.23886/ejki.3.4803.
- Oviaño, M., Barba, M.J., Fernández, B., Ortega, A., Aracil, B., Oteo, J., et al., 2016. Rapid Detection of OXA-48-Producing Enterobacteriaceae by Matrix-Assisted Laser Desorption Ionization Time of Flight Mass Spectrometry. *J. Clin. Microbiol.* 54: 754–759. doi:10.1128/JCM.02496-15
- Papagiannitsis, C.C., Študentová, V., Izdebski, R., Oikonomou, O., Pfeifer, Y., Petinaki, E., et al., 2015. Matrix-assisted laser desorption ionization-time of flight mass spectrometry meropenem hydrolysis assay with NH<sub>4</sub>HCO<sub>3</sub>, a reliable tool for direct detection of carbapenemase activity. *J. Clin. Microbiol.* 53: 1731–1735. doi:10.1128/JCM.03094-14
- Papp-Wallace, K.M., Endimiani, A., Taracila, M.A., & Bonomo, R.A., 2011. Carbapenems: Past, present, and future. *Antimicrob. Agents Chemother.* 55: 4943–4960. doi:10.1128/AAC.00296-11
- Papst, L., Beović, B., Pulcini, C., Durante-Mangoni, E., Rodríguez-Baño, J., Kaye, K.S., et al., 2018. Antibiotic treatment of infections caused by carbapenem-resistant Gram-negative bacilli: an international ESCMID cross-sectional survey among infectious diseases specialists practicing in large hospitals. *Clin. Microbiol. Infect.* 24: 1070–1076. doi:10.1016/j.cmi.2018.01.015
- Paraton, H., 2018. Program pengendalian resistensi antimikroba di indonesia hasil capaian dan target ke depan.
- Peirano, G., Schreckenberger, P.C., & Pitout, J.D.D., 2011. Characteristics of NDM-1-Producing Escherichia coli Isolates That Belong to the Successful and Virulent Clone ST131. *Antimicrob. Agents Chemother.* 55: 2986–2988. doi:10.1128/AAC.01763-10
- Peleg, A.Y., & Hooper, D.C., 2010. Hospital-acquired infections due to gram-negative bacteria. *N. Engl. J. Med.* doi:10.1056/NEJMra0904124
- Perez, K.K., Olsen, R.J., Musick, W.L., Cernoch, P.L., Davis, J.R., Land, G.A., et al., 2013. Integrating rapid pathogen identification and antimicrobial stewardship significantly decreases hospital costs. *Arch. Pathol. Lab. Med.* 137: 1247–1254. doi:10.5858/arpa.2012-0651-OA
- Poirel, L., Naas, T., Nicolas, D., Collet, L., Bellais, S., Cavallo, J.D., et al., 2000. Characterization of VIM-2, a carbapenem-hydrolyzing metallo- $\beta$ -lactamase and

- its plasmid- and integron-borne gene from a *Pseudomonas aeruginosa* clinical isolate in France. *Antimicrob. Agents Chemother.* 44: 891–897. doi:10.1128/AAC.44.4.891-897.2000
- Poirel, L., Pitout, J.D., & Nordmann, P., 2007a. Carbapenemases: Molecular diversity and clinical consequences. *Future Microbiol.* doi:10.2217/17460913.2.5.501
- Poirel, L., Pitout, J.D., & Nordmann, P., 2007b. Carbapenemases: Molecular diversity and clinical consequences. *Future Microbiol.* doi:10.2217/17460913.2.5.501
- Potron, A., Poirel, L., & Nordmann, P., 2014. Derepressed transfer properties leading to the efficient spread of the plasmid encoding carbapenemase OXA-48. *Antimicrob. Agents Chemother.* 58: 467–471. doi:10.1128/AAC.01344-13
- Queenan, A.M., & Bush, K., 2007. Carbapenemases: The versatile  $\beta$ -lactamases. *Clin. Microbiol. Rev.* 20: 440–458. doi:10.1128/CMR.00001-07
- Rahman, A., 2018. Carbapenem-Resistant Enterobacteriaceae: Clinico-Epidemiological Perspective, Tropical Biomedicine.
- Rasmussen, B.A., Bush, K., Keeney, D., Yang, Y., Hare, R., O’Gara, C., et al., 1996. Characterization of IMI-1  $\beta$ -lactamase, a class a carbapenem- hydrolyzing enzyme from *Enterobacter cloacae*. *Antimicrob. Agents Chemother.* 40: 2080–2086. doi:10.1128/aac.40.9.2080
- RINI LATIFAH Indonesia, U., 2014. Deteksi Enzim Karbapenemase dan Gen Pengkodanya pada Isolat *Pseudomonas aeruginosa* dan *Acinetobacter baumannii* Resisten Karbapenem di ICU-RSUPN CiptoMangunkusumo tahun 2011. UNIVERSITAS INDONESIA Deteksi.
- Sabino, Y.N.V., Santana, M.F., Oyama, L.B., Santos, F.G., Moreira, A.J.S., Huws, S.A., et al., 2019. Characterization of antibiotic resistance genes in the species of the rumen microbiota. *Nat. Commun.* 10: 1–11. doi:10.1038/s41467-019-13118-0
- Samanta, I., & Bandyopadhyay, S., 2020. Carbapenem resistance. *Antimicrob. Resist. Agric.* 59–69. doi:10.1016/b978-0-12-815770-1.00007-9
- Scott, D., 2015. The Mechanics of Antibiotic Resistance. *Amaz. Sci.* 1–18.
- Shortell, S.M., Zimmerman, J.E., Rousseau, D.M., Gillies, R.R., Wagner, D.P., Draper, E.A., et al., 1994. The performance of intensive care units: Does good management make a difference? *Med. Care* 32: 508–525. doi:10.1097/00005650-199405000-00009
- Singer, M., Deutschman, C.S., Seymour, C., Shankar-Hari, M., Annane, D., Bauer, M., et al., 2016. The third international consensus definitions for sepsis and septic shock (sepsis-3). *JAMA - J. Am. Med. Assoc.* doi:10.1001/jama.2016.0287
- Srinivasan, A., & Patel, J.B., 2008. *Klebsiella pneumoniae* Carbapenemase–Producing Organisms: An Ounce of Prevention Really Is Worth a Pound of Cure . *Infect. Control Hosp. Epidemiol.* 29: 1107–1109. doi:10.1086/594129
- Suharti, R.R.N., 2012. Dan identifikasi, DETEKSI DAN IDENTIFIKASI ENZIM METALLO- BETA IACTAMASE (MBL) PADA BAKTERI PATOGEN YANG RESISTEN TERHADAP ANTIBIOTIKA CARBAPENEM.
- Sumita, Y., & Fakasawa, M., 1995. Potent activity of meropenem against *Escherichia*



- coli arising from its simultaneous binding to penicillin-binding proteins 2 and 3. *J. Antimicrob. Chemother.* 36: 53–64. doi:10.1093/jac/36.1.53
- Tacconelli, E; Magrini, N., 2017. WHO | Global priority list of antibiotic-resistant bacteria to guide research, discovery, and development of new antibiotics. *Who*.
- Tamma, P.D., Opene, B.N.A., Gluck, A., Chambers, K.K., Karen C. Carroll, & Simner, P.J., 2017. Comparison of 11 Phenotypic Assays for Accurate Detection of Carbapenemase- Producing Enterobacteriaceae. *J. Clin. Microbiol.* 55: 1046–1055.
- Tamma, P.D., & Simner, P.J., 2018a. Phenotypic Detection of Carbapenemase-Producing Organisms from Clinical Isolates. *J. Clin. Microbiol.* 56.
- Tamma, P.D., & Simner, P.J., 2018b. Phenotypic detection of carbapenemase-producing organisms from clinical isolates. *J. Clin. Microbiol.* 56: 1–13. doi:10.1128/JCM.01140-18
- Tamma, P.D., & Simner, P.J., 2018c. Phenotypic detection of carbapenemase-producing organisms from clinical isolates. *J. Clin. Microbiol.* doi:10.1128/JCM.01140-18
- Thaden, J.T., Pogue, J.M., & Kaye, K.S., 2017. Role of newer and re-emerging older agents in the treatment of infections caused by carbapenem-resistant Enterobacteriaceae. *Virulence*. doi:10.1080/21505594.2016.1207834
- Thomson, G., Turner, D., Brasso, W., Kircher, S., Guillet, T., & Thomson, K., 2017. High-stringency evaluation of the automated BD phoenix CPO detect and rapidec carba NP tests for detection and classification of carbapenemases. *J. Clin. Microbiol.* 55: 3437–3443. doi:10.1128/JCM.01215-17
- Tsakris, A., Poulou, A., Bogaerts, P., Dimitroulia, E., Pournaras, S., & Glupczynski, Y., 2015. Evaluation of a new phenotypic OXA-48 disk test for differentiation of OXA-48 carbapenemase-producing Enterobacteriaceae clinical isolates. *J. Clin. Microbiol.* 53: 1245–1251. doi:10.1128/JCM.03318-14
- Tzouveleakis, L.S., Markogiannakis, A., Psychogiou, M., Tassios, P.T., & Daikos, G.L., 2012. Carbapenemases in *Klebsiella pneumoniae* and other Enterobacteriaceae: An evolving crisis of global dimensions. *Clin. Microbiol. Rev.* 25: 682–707. doi:10.1128/CMR.05035-11
- van Dam, V., Olrichs, N., & Breukink, E., 2009. Specific labeling of peptidoglycan precursors as a tool for bacterial cell wall studies. *ChemBioChem*. doi:10.1002/cbic.200800678
- van Duin, D., Cober, E.D., Richter, S.S., Perez, F., Cline, M., Kaye, K.S., et al., 2014. Tigecycline therapy for carbapenem-resistant *Klebsiella pneumoniae* (CRKP) bacteriuria leads to tigecycline resistance. *Clin. Microbiol. Infect.* 20: O1117–O1120. doi:10.1111/1469-0691.12714
- Váradi, L., Luo, J.L., Hibbs, D.E., Perry, J.D., Anderson, R.J., Orenge, S., et al., 2017. Methods for the detection and identification of pathogenic bacteria: Past, present, and future. *Chem. Soc. Rev.* doi:10.1039/c6cs00693k
- Vardakas, K.Z., Matthaiou, D.K., Falagas, M.E., Antypa, E., Koteli, A., & Antoniadou, E., 2015. Characteristics, risk factors and outcomes of carbapenem-resistant

- Klebsiella pneumoniae infections in the intensive care unit. *J. Infect.* 70: 592–599. doi:10.1016/j.jinf.2014.11.003
- Ventola, C.L., 2015. The antibiotic resistance crisis: causes and threats. *P T J.* 40: 277–283. doi:Article
- Verma, N., Prahraj, A., Mishra, B., Behera, B., & Gupta, K., 2019. Detection of carbapenemase-producing *Pseudomonas aeruginosa* by phenotypic and genotypic methods in a tertiary care hospital of East India. *J. Lab. Physicians* 11: 287–291. doi:10.4103/jlp.jlp\_136\_19
- Viale, P., Giannella, M., Lewis, R., Trecarichi, E.M., Petrosillo, N., & Tumbarello, M., 2013. Predictors of mortality in multidrug-resistant *Klebsiella pneumoniae* bloodstream infections. *Expert Rev. Anti. Infect. Ther.* doi:10.1586/14787210.2013.836057
- Villegas, M.V., Pallares, C.J., Escandón-Vargas, K., Hernández-Gómez, C., Correa, A., Álvarez, C., et al., 2016. Characterization and clinical impact of bloodstream infection caused by carbapenemase-producing enterobacteriaceae in seven Latin American countries. *PLoS One* 11. doi:10.1371/journal.pone.0154092
- Vincent, J.L., Moreno, R., Takala, J., Willatts, S., De Mendonça, A., Bruining, H., et al., 1996. The SOFA (Sepsis-related Organ Failure Assessment) score to describe organ dysfunction/failure. *Intensive Care Med.* 22: 707–710. doi:10.1007/BF01709751
- Walsh, T.R., 2010. Emerging carbapenemases: A global perspective. *Int. J. Antimicrob. Agents* 36: S8. doi:10.1016/S0924-8579(10)70004-2
- Walsh, T.R., Toleman, M.A., Poirel, L., & Nordmann, P., 2005. Metallo- $\beta$ -lactamases: The quiet before the storm? *Clin. Microbiol. Rev.* doi:10.1128/CMR.18.2.306-325.2005
- Wang, W., Arshad, M.I., Khurshid, M., Rasool, M.H., Nisar, M.A., Aslam, M.A., et al., 2018. Antibiotic resistance : a rundown of a global crisis. *Infect. Drug Resist.* 1645–1658.
- Williamson, D.A., Sidjabat, H.E., Freeman, J.T., Roberts, S.A., Silvey, A., Woodhouse, R., et al., 2012. Identification and molecular characterisation of New Delhi metallo- $\beta$ -lactamase-1 (NDM-1)- and NDM-6-producing Enterobacteriaceae from New Zealand hospitals, in: *International Journal of Antimicrobial Agents*. pp. 529–533. doi:10.1016/j.ijantimicag.2012.02.017
- Woodford, N., Tierno, P.M., Young, K., Tysall, L., Palepou, M.F.I., Ward, E., et al., 2004. Outbreak of *Klebsiella pneumoniae* producing a new carbapenem-hydrolyzing class A  $\beta$ -lactamase, KPC-3, in a New York Medical Center. *Antimicrob. Agents Chemother.* 48: 4793–4799. doi:10.1128/AAC.48.12.4793-4799.2004
- Zarkotou, O., Pournaras, S., Tselioti, P., Dragoumanos, V., Pitiriga, V., Ranellou, K., et al., 2011. Predictors of mortality in patients with bloodstream infections caused by KPC-producing *Klebsiella pneumoniae* and impact of appropriate antimicrobial treatment. *Clin. Microbiol. Infect.* 17: 1798–1803. doi:10.1111/j.1469-0691.2011.03514.x



- Zhanel, G.G., Wiebe, R., Dilay, L., Thomson, K., Rubinstein, E., Hoban, D.J., et al., 2007. Comparative review of the carbapenems. *Drugs* 67: 1027–1052. doi:10.2165/00003495-200767070-00006
- Zwaluw, K. Van Der, Haan, A. De, Pluister, G.N., & Bootsma, H.J., 2015. The Carbapenem Inactivation Method ( CIM ), a Simple and Low-Cost Alternative for the Carba NP Test to Assess Phenotypic Carbapenemase Activity in Gram-Negative Rods 1–13. doi:10.1371/journal.pone.0123690



UNIVERSITAS  
GADJAH MADA

**Prevalensi dan tingkat Keparahan Infeksi Bakteri Gram Negatif Batang Penghasil Karbapenemase**  
SHIRLEY, Dr. dr. Osman Sianipar DMM, M.Sc., Sp.PK (K).; Dr. dr. Siti Muchayat P., MS., Sp.PK (K)  
Universitas Gadjah Mada, 2020 | Diunduh dari <http://etd.repository.ugm.ac.id/>