

REFERENCES

- Almangour, T. A., Alruwaili, A., Almutairi, R., Alrasheed, A., Alhifany, A., Eljaaly., Alkofide., H., Alhammad., A. M., Ghonem, L., Alsharidi, A., 2021. Aerosolized plus intravenous colistin vs intravenous colistin alone for the treatment of nosocomial pneumonia due to multidrug resistant Gram-negative bacteria: A retrospective cohort study. *International Journal of Infectious Diseases*. 406-412. Doi: 10.1016/j.ijid.2021.06.007.
- Anar, C., Bicmen C., Guldaval, F., 2022. Antibiotic resistance rates and penicillin MIC distribution in patients with streptococcal pneumonia between 2013-2019, and the use of antibiotics in clinical practice. *Indian Journal of Medical Microbiology*.
- Almirall, J. et al. Epidemiology of community-acquired pneumonia in adults: a population-based study. *Eur. Respir. J.* 15, 757–763.
- Asai N, Mikamo H., 2021. Recent Topics of Pneumococcal Vaccination: Indication of Pneumococcal Vaccine for Individuals at a Risk of Pneumococcal Disease in Adults. *Microorganisms*. 12;9(11)
- Assefa, M., 2022. Multidrug-resistant gram-negative bacterial pneumonia: etiology, risk factors, and drug resistance patterns. *National Library of Medicine*.
- Bassetti, M. et al., 2018. Risk stratification and treatment of ICU-acquired pneumonia caused by multidrug-resistant/extensively drug-resistant/pan drug-resistant bacteria. *Curr. Opin. Crit. Care* 24, 385–393.
- Bradley, J. S. et al., 2011. The management of community-acquired pneumonia in infants and children older than three months of age: clinical practice guidelines by the Pediatric Infectious Diseases Society and the Infectious Diseases Society of America. *Clin. Infect. Dis.* 53, e25–e76.
- Breijyeh Z, Jubeh B, Karaman R. Resistance of gram-negative bacteria to current antibacterial agents and approaches to resolve it. *Molecules*. 1340.
- Chalmers, J. D. et al. Epidemiology, antibiotic therapy, and clinical outcomes in healthcare-associated pneumonia: a UK cohort study. *Clin. Infect. Dis.* 53, 107–113 (2011).
- Chang, Y., Jeon, K., Lee, S., Cho, Y., Kim, Y., Chong, Y., Hong, S., 2021. The Distribution of Multidrug-resistant Microorganisms and Treatment Status of Hospital-acquired Pneumonia/Ventilator-associated Pneumonia in Adult Intensive Care Units: a Prospective Cohort Observational Study. *J. Korean Med.* 36(41), e251. Doi: 10.3346/jkms.2021.36.e251
- China Antimicrobial Surveillance Network. Distribution of main strains of 76333 respiratory specimen isolates (CHINET 2017). Available from: <http://www.chinets.com/Data/AntibioticDrugFast> (Accessed October 8th, 2022)

- Chiotos K., Hayes M., Gerber, J. S., Tamma P. D., 2020. Treatment of Carbapenem-Resistant Enterobacteriaceae Infections in Children. *Journal of the Pediatric Infectious Diseases Society*, Volume 9, Issue 1, March 2020, Pages 56–66. Available from <https://academic.oup.com/jpids/article/9/1/56/5686153/> (Accessed October 9th, 2022).
- Cilloniz, C et al., 2011. Microbial etiology of community-acquired pneumonia and its relation to severity. *Thorax* 66, 340–346.
- CLSI (Clinical and Laboratory Standards Institute), 2020. *Performance Standards for Antimicrobial Susceptibility Testing*. 30th ed. CLSI supplement M100. Wayne, PA: Clinical and Laboratory Standards Institute.
- Cowley, M. C., Ritchie, D. J., Hampton, N., Kollef, M., H., Micek, S. T., 2018. Outcomes Associated With De-Escalating Anti-Methicillin-Resistant *Staphylococcus aureus* Therapy in Culture-Negative Nosocomial Pneumonia. *Chest*. DOI: <https://doi.org/10.1016/j.chest.2018.10.014>
- da Costa, B.R. et al., 2011. Uses and misuses of the STROBE statement: bibliographic study. *BMJ Open*, 1(1), pp. e000048–e000048. doi:10.1136/bmjopen-2010-000048.
- David, S. et al., 2019. The epidemic of carbapenem-resistant *Klebsiella pneumoniae* in Europe is driven by the nosocomial spread. *Nat. Microbiol.* 4, 1919–1929.
- El Moussaoui, R. et al. Long-term symptom recovery and health-related quality of life in patients with mild-to-moderate-severe community-acquired pneumonia. *Chest* 1165–1172.
- Falcone, M., Tiseo, G., Leonildi, A., Sala, L. D., Vecchione, A., Barnini, S., Farcomeni, A., Menichetti, F., 2022. Cefiderocol- Compared to Colistin-Based Regimens for the Treatment of Severe Infections Caused by Carbapenem-Resistant *Acinetobacter baumannii*. *American Society for Microbiology*. 66(5): e02142-21. Doi: 10.1128/aac.02142-21.
- Feng, J.Y., Peng, C. K., Sheu, C. C., Lin, Y. C., Chan, M.C., Wang, S. H., Chen, C. M., Shen, Y. C., Zheng, Z. R. Lin, Y. T., Yang, K. Y., 2021. Efficacy of adjunctive nebulized colistin in critically ill patients with nosocomial carbapenem-resistant Gram-negative bacterial pneumonia: a multi-center observational study. *Clinical Microbiology and Infection*. 1465-1473.
- Garin, N. et al., 2014. β -Lactam monotherapy vs. β -lactam-macrolide combination treatment in moderately severe community-acquired pneumonia: a randomized noninferiority trial. *JAMA Intern. Med.* 174, 1894–1901.
- Grief S. N., Loza, J. K., 2018. Guidelines for the Evaluation and Treatment of Pneumonia. Available. 10.1016/j.pop.2018.04. Available from <https://pubmed.ncbi.nlm.nih.gov/30115336/>. (Accessed October 8th, 2022).

- Jain, S. et al., 2015. Community-acquired pneumonia requiring hospitalization among US adults. *N. Engl. J. Med.* 373, 415–427.
- Kalil, A. C. et al., 2016. Management of adults with hospital-acquired and ventilator-associated pneumonia: 2016 clinical practice guidelines by the Infectious Diseases Society of America and the American Thoracic Society. *Clin. Infect. Dis.* 63, e61–e111.
- Kollef, M. H. et al., 2019. Ceftolozane-tazobactam versus meropenem for treatment of nosocomial pneumonia (ASPECT-NP): a randomized, controlled, double-blind, phase 3, noninferiority trial. *Lancet Infect. Dis.* 19, 1299– 1311.
- Huang J, Luo S, Huang M, Zhang T, Min Z, Liu C, Zhang Q, Yang J, Min X., 2019. Protection against fatal pneumonia through mucosal and subcutaneous immunization with the pneumococcal SP0148 protein. *Microb Pathog.* 129:206-212.
- Ito, A., Ishida, T., Tachibana, H., Nakanishi, Y., Yamazaki, A., Washio, Y., 2020. Is antipseudomonal antibiotic treatment needed for all nursing and healthcare-associated pneumonia patients at risk for antimicrobial resistance? *Journal of Global Resistance* 22. 41–447. Doi: 10.1016/j.jgar.2020.04.021.
- Lamping, D. L. et al. The community-acquired pneumonia symptom questionnaire: a new, patient-based outcome measure to evaluate symptoms in patients with community-acquired pneumonia. *Chest* 122, 920–929.
- Le, M. N.-T et al., 2020. Oral colonization by antimicrobial-resistant Gram-negative bacteria among long-term care facility residents: prevalence, risk factors, and molecular epidemiology. *Antimicrob. Resist. Infect. Control.* 9, 45.
- Lui, G., To H. K. W., Lee, N., et al., 2020. Adherence to Treatment Guidelines Improves Patient Outcomes in a Prospective Cohort of Adults Hospitalized for Community-Acquired Pneumonia. Available from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7243378/>. (Accessed October 9th, 2022).
- Magiorakos, A.-P. et al., 2012. Multidrug-resistant, extensively drug-resistant and pan drug-resistant bacteria: an international expert proposal for interim standard definitions for acquired resistance. *Clin. Microbiol. Infect.* 18, 268–281.
- Mandell, L. A. et al., 2007. Infectious Diseases Society of America/American Thoracic Society consensus guidelines on the management of community-acquired pneumonia in adults. *Clin. Infect. Dis.* 44 (Suppl 2), S27–S72.
- Mandell, L. A. & Niederman, M. S., 2019. Aspiration pneumonia. *N. Engl. J. Med.* 380, 651–663.

- Marijam A, Olbrecht J, Ozakay A, Eken V, Meszaros K., 2019. Cost-Effectiveness Comparison of Pneumococcal Conjugate Vaccines in Turkish Children. *Value Health Reg Issues*. 19:34-44.
- Martin-Loeches, I. et al., 2013. Potentially resistant microorganisms in intubated patients with hospital-acquired pneumonia: the interaction of ecology, shock and risk factors. *Intensive Care Med*. 39, 672–681.
- Metlay, J. P. et al., 2019. Diagnosis and treatment of adults with community-acquired pneumonia. An Official Clinical Practice Guideline of the American Thoracic Society and Infectious Diseases Society of America. *Am. J. Respir. Crit. Care Med*. 200, e45–e67.
- Murray C. J., Ikuta, K. S., Sharara, L.S., Darboe, S., et al., 2022. Articles Global Burden of Bacterial Antimicrobial Resistance in 2019: A Systematic Analysis. *The Lancet*, 399.
- Niederman, M. S., 2015. Macrolide-resistant pneumococcus in community-acquired pneumonia. Is there still a role for macrolide therapy? *Am. J. Respir. Crit. Care Med*. 191, 1216–1217.
- Noorgard, S. M., Jensen C. S., Aalestrup, J, et al., 2019. Choice of therapeutic interventions and outcomes for the treatment of infections caused by multidrug-resistant gram-negative pathogens: a systematic review. *National Library of Medicine*.
- Our World in Data, 2019. Pneumonia. Available from <https://ourworldindata.org/pneumonia> (Accessed October 9th, 2022).
- Ozawa, S., Chen, H., Rao, G., Egale, T., Stringer, A., 2021. Value of pneumococcal vaccination in controlling the development of antimicrobial resistance (AMR): Case study using DREAMR in Ethiopia. *Vaccine*. 6700–6711.
- Ozlu T, Bulbul Y, Aydin D, Tatar D, Kuyucu T, Erboy F, Koseoglu HI, Anar C, Sunnetcioglu A, Gulhan PY, Sahin U, Ekici A, Duru S, Ulasli SS, Kurtipek E, Gunay S., 2019. IMPACT Study Investigators. Immunization status in chronic obstructive pulmonary disease: A multicenter study from Turkey. *Ann Thorac Med*. 75-82.
- Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ* 2021;372:n71. doi: 10.1136/bmj.n71
- Park, S. Y., Lee, E. J., Kim, T., Yu, S. N., Park, K. H., Lee, M. S., Park, S. Y., Jeon, M. H., Kim, T. H., Choo, E. J., 2018. Early administration of appropriate antimicrobial agents to improve the outcome of carbapenem-resistant *Acinetobacter baumannii* complex bacteremic pneumonia. *International Journal of Antimicrobial Agents*. 407-412.
- Postma, D. F. et al., 2019. Cardiac events after macrolides or fluoroquinolones in patients hospitalized for community-acquired pneumonia: posthoc analysis of a cluster-randomized trial. *BMC Infect. Dis*. 19, 17.

- Renzoni, A. J., Peksa, G. D., DeMott, J. M., 2021. Emergency department methicillin-resistant *Staphylococcus aureus* naive screen effect on pneumonia treatment duration. *American Journal of Emergency*. 68–71. Doi:1016/j.ajem.2021.01.066.
- Sefah, I. A., Essah, D. O., Kurdi, A., et al., 2021. Assessment of adherence to pneumonia guidelines and its determinants in an ambulatory care clinic in Ghana: findings and implications for the future. *National Library of Vaccine*.
- Shorr, A., Simmons, J., Hampton, N., Micek, S. T., Kollef, M., 2021. Pneumococcal community-acquired pneumonia in the intensive care unit: Azithromycin remains protective despite macrolide resistance. *Respiratory Medicine*. Doi: <https://doi.org/10.1016/j.rmed.2021.106307>.
- Siemieniuk RA, Gregson DB, Gill MJ., 2011. The persisting burden of invasive pneumococcal disease in HIV patients: an observational cohort study. *BMC Infect Dis*. 11:314.
- Smith P. G., Morrow RH, Ross D. A., 2015. *Field Trials of Health Interventions: A Toolbox*. 3rd ed. Oxford: OUP Oxford.
- Tereziu, S., Minter, D. A., 2022. *Pneumococcal Vaccine*. Oakland: StatsPearl Publishing.
- Torres, A., Peetermans, W. E., Viegi, G. & Blasi, F., 2013. Risk factors for community-acquired pneumonia in adults in Europe: a literature review. *Thorax* 68, 1057–1065.
- Torres, A. et al., 2017. International ERS/ESICM/ESCMID/ALAT guidelines for the management of hospital-acquired pneumonia and ventilator-associated pneumonia. *Eur. Respir. J.* 50, 1700582.
- Torres, A., Cilloniz, C., Niederman, M. S., 2021. Pneumonia. *Nat Rev Dis Primers* 7, 25.
- Webb, B. J. et al., 2016. Derivation and multicenter validation of the drug resistance in pneumonia clinical prediction score. *Antimicrob. Agents Chemother.* 60, 2652–2663.
- Webb, B. J., Sorensen, J., Mecham, I. Buckel, W., Ooi, L., Al, J., Dean, N. C., 2019. Antibiotic Use and Outcomes After Implementation of the Drug Resistance in Pneumonia Score in ED Patients With Community-Onset Pneumonia. *Chest*. DOI: 10.1016/j.chest.2019.04.093.
- Wiese AD, Griffin MR, Grijalva CG., 2019. Impact of pneumococcal conjugate vaccines on hospitalizations for pneumonia in the United States. *Expert Rev Vaccines*. 327-341.
- Wootton, D. G. et al., 2017. A longitudinal modeling study estimates acute symptoms of community-acquired pneumonia recover to baseline by 10 days. *Eur. Respir. J.* 49, 1602170.

World Health Organization (WHO), 2021. Pneumonia.
<https://www.who.int/newsroom/fact-sheets/detail/pneumonia> (Accessed
October 5th, 2022)

Xu, Y., Jin, L, Liu, Ning., Luo, X., Dong, D., Tang, J., Wang, Y., You, Y., Liu, Y., Chen, M., Yu, Z., Hao, Y., Gu., Q. 2019., Evaluation of the ratio of the estimated area under the concentration-time curve to minimum inhibitory concentration (estimated AUIC) as a predictor of the outcome for tigecycline treatment for pneumonia due to multidrug-resistant bacteria in an intensive care unit. *International Journal*