

GOLD REPORT 2025 KEY CHANGES SUMMARY

Document Layout, References & Figures

In total **164 new references** have been added to the GOLD 2025 report as listed alphabetically at the end of this document. PubMed links (where available) have been included in the reference list.

In the 2025 revision of the GOLD report several changes have been made as follows:

- ▶ **Chapter 6: COVID-19 and COPD** has been removed and the chapters included in the 2025 document are as follows:
 - **Chapter 1: Definition and Overview**
 - **Chapter 2: Diagnosis and Assessment**
 - **Chapter 3: Prevention and Management of COPD**
 - **Chapter 4: Management of Exacerbations**
 - **Chapter 5: COPD and Comorbidities**
- ▶ Three new figures have been introduced for 2025:
 - **New Figure 2.6 ‘Pre- and Post- Bronchodilator Spirometry’**
 - **New Figure 3.22 ‘Management of Patients Currently on LABA+ICS’**
 - **New Figure 5.1 ‘Treatable Traits in Pulmonary Hypertension-COPD (PH-COPD) & Suggested Management’**
- ▶ The following figures have been edited or updated:
 - **Figure 3.6 ‘Vaccination for Stable COPD’** has been updated with the latest vaccination recommendations
 - **Figure 3.9 ‘Follow-up Pharmacological Treatment’** has been updated to add information about new treatments ensifentrine and dupilumab
 - **Figure 4.11 ‘Interventions that Reduce the Frequency of COPD Exacerbations’** has had dupilumab added.
 - **Figure 3.18 ‘Maintenance Medications in COPD’**
 - **Figure 3.19 ‘Bronchodilators in Stable COPD’** has been updated to include ensifentrine
 - **Figure 3.20 ‘Anti-Inflammatory Therapy in Stable COPD’** has been updated to include ensifentrine and dupilumab
 - **Figure 4.2 ‘Exacerbations: Diagnosis and Assessment’**

Key Changes

- i. **Chapter 6** on the topic of **COVID-19 and COPD** has now been removed from the GOLD report.
- ii. Three new figures have been introduced for 2025:
 - New **Figure 2.6 ‘Pre- and Post- Bronchodilator Spirometry’**
 - New **Figure 3.22 ‘Management of Patients Currently on LABA+ICS’**
 - New **Figure 5.1 ‘Treatable Traits in Pulmonary Hypertension-COPD (PH-COPD) & Suggested Management’**
- iii. The following figures have been edited or updated:
 - Figure 3.6 ‘Vaccination for Stable COPD’** has been updated with the latest vaccination recommendations
 - Figure 3.9 ‘Follow-up Pharmacological Treatment’** has been updated to add information about new treatments ensifentrine and dupilumab
 - Figure 3.18 ‘Maintenance Medications in COPD’** has been updated and ensifentrine and dupilumab have been included
 - Figure 4.11 ‘Interventions that Reduce the Frequency of COPD Exacerbations’** has had dupilumab added.

- dupilumab added.
- iv. A new paragraph and references have been added to the **Trajectories of Lung Function: Development and Aging** section, including a link to free software on the ERS website for monitoring spirometry over time (Page 11)
 - v. A new section on **Dysbiosis** has been included (Page 17)
 - vi. The information on **Spirometry** has been updated to include more comprehensive information on LLN values, z-scores and reference values and a new **Figure 2.6 Pre- and Post-Bronchodilator Spirometry** has been added (Page 27)
 - vii. **Cardiovascular Risk in COPD** is now covered in a new section (Page 38)
 - viii. **Computed Tomography (CT)** has been updated and now includes information on emphysema, lung nodules, airways and COPD related morbidities (Page 42)
 - ix. **Climate Change & COPD** is now included (Page 50)
 - x. **Vaccination Recommendations** for people with COPD have been updated in line with current guidance from the US Centers for Disease Control (CDC) (Page 52)
 - xi. **Follow-up Pharmacological Treatment** and corresponding **Figure 3.9** have been updated to include information about ensifentribe and dupilumab (Page 57)
 - xii. Information about the **Delivery of Pulmonary Rehabilitation, Education & Self-management: in-person versus virtual** has been included (Page 67), **Remote Patient Follow-up** has been moved from the COVID-19 chapter to this part of the document and the **COPD Follow-up Checklist** has been moved to the Appendix (Page 135)
 - xiii. The section on withdrawal of ICS has been revised and a new **Figure 3.22** about the **Management of Patients Currently on LABA+ICS** has been included (Page 88)
 - xiv. The sections on **Phosphodiesterase 3 and 4 (PDE3 & PDE4) Inhibitors and Other Drugs with the Potential to Reduce Exacerbations** have been revised to reflect the latest evidence for ensifentribe and dupilumab (Page 91)
 - xv. **Pulmonary Hypertension** is now covered, and a corresponding **Figure 5.1** has been added (Page 126)

NEW REFERENCES ADDED

New references added to the GOLD 2025 report (listed alphabetically):

- Agusti A, Böhm M, Celli B, et al. GOLD COPD DOCUMENT 2023: a brief update for practicing cardiologists. *Clin Res Cardiol* 2024; **113**(2): 195-204 <https://pubmed.ncbi.nlm.nih.gov/37233751>.
- Agustí A, Edwards LD, Rennard SI, et al. Persistent systemic inflammation is associated with poor clinical outcomes in COPD: a novel phenotype. *PLoS One* 2012; **7**(5): e37483 <https://pubmed.ncbi.nlm.nih.gov/22624038>.
- Alkodaymi MS, Omrani OA, Fawzy NA, et al. Prevalence of post-acute COVID-19 syndrome symptoms at different follow-up periods: a systematic review and meta-analysis. *Clin Microbiol Infect* 2022; **28**(5): 657-66 <https://pubmed.ncbi.nlm.nih.gov/35124265>.
- Allbright K, Villandre J, Crotty Alexander LE, et al. The paradox of the safer cigarette: understanding the pulmonary effects of electronic cigarettes. *Eur Respir J* 2024; **63**(6): <https://pubmed.ncbi.nlm.nih.gov/38609098>.
- Altree TJ, Toson B, Loffler KA, Ekström M, Currow DC, Eckert DJ. Low-Dose Morphine Does Not Cause Sleepiness in COPD: A Secondary Analysis of a Randomized Trial. *Am J Respir Crit Care Med* 2024: <https://pubmed.ncbi.nlm.nih.gov/38477675>.
- Analitis A, Katsouyanni K, Biggeri A, et al. Effects of cold weather on mortality: results from 15 European cities within the PHEWE project. *Am J Epidemiol* 2008; **168**(12): 1397-408 <https://pubmed.ncbi.nlm.nih.gov/18952849>.
- Analitis A, Michelozzi P, D'Ippoliti D, et al. Effects of heat waves on mortality: effect modification and confounding by air pollutants. *Epidemiology* 2014; **25**(1): 15-22 <https://pubmed.ncbi.nlm.nih.gov/24162013>.
- Anderson GB, Dominici F, Wang Y, McCormack MC, Bell ML, Peng RD. Heat-related emergency hospitalizations for respiratory diseases in the Medicare population. *Am J Respir Crit Care Med* 2013; **187**(10): 1098-103 <https://pubmed.ncbi.nlm.nih.gov/23491405>.

- Anenberg SC, Haines S, Wang E, Nassikas N, Kinney PL. Synergistic health effects of air pollution, temperature, and pollen exposure: a systematic review of epidemiological evidence. *Environ Health* 2020; **19**(1): 130 <https://pubmed.ncbi.nlm.nih.gov/33287833>.
- Anzueto A, Barjaktarevic IZ, Siler TM, et al. Ensifentrine, a Novel Phosphodiesterase 3 and 4 Inhibitor for the Treatment of Chronic Obstructive Pulmonary Disease: Randomized, Double-Blind, Placebo-controlled, Multicenter Phase III Trials (the ENHANCE Trials). *Am J Respir Crit Care Med* 2023; **208**(4): 406-16 <https://pubmed.ncbi.nlm.nih.gov/37364283>.
- Azhar GS, Mavalankar D, Nori-Sarma A, et al. Heat-related mortality in India: excess all-cause mortality associated with the 2010 Ahmedabad heat wave. *PLoS One* 2014; **9**(3): e91831 <https://pubmed.ncbi.nlm.nih.gov/24633076>.
- Backman H, Blomberg A, Lundquist A, et al. Lung Function Trajectories and Associated Mortality among Adults with and without Airway Obstruction. *Am J Respir Crit Care Med* 2023; **208**(10): 1063-74 <https://pubmed.ncbi.nlm.nih.gov/37460250>.
- Bai J, Cui J, Yu C. Burden of chronic obstructive pulmonary disease attributable to non-optimal temperature from 1990 to 2019: a systematic analysis from the Global Burden of Disease Study 2019. *Environ Sci Pollut Res Int* 2023; **30**(26): 68836-47 <https://pubmed.ncbi.nlm.nih.gov/37129808>.
- Balasubramanian A, Gearhart AS, Putcha N, et al. Diffusing Capacity as a Predictor of Hospitalizations in a Clinical Cohort of Chronic Obstructive Pulmonary Disease. *Ann Am Thorac Soc* 2024; **21**(2): 243-50 <https://pubmed.ncbi.nlm.nih.gov/37870393>.
- Ballering AV, van Zon SKR, Olde Hartman TC, Rosmalen JGM. Persistence of somatic symptoms after COVID-19 in the Netherlands: an observational cohort study. *Lancet* 2022; **400**(10350): 452-61 <https://pubmed.ncbi.nlm.nih.gov/35934007>.
- Basu R, Feng WY, Ostro BD. Characterizing temperature and mortality in nine California counties. *Epidemiology* 2008; **19**(1): 138-45 <https://pubmed.ncbi.nlm.nih.gov/18091422>.
- Basu R, Samet JM. Relation between elevated ambient temperature and mortality: a review of the epidemiologic evidence. *Epidemiol Rev* 2002; **24**(2): 190-202 <https://pubmed.ncbi.nlm.nih.gov/12762092>.
- Bell ML, Ebisu K, Peng RD, et al. Seasonal and regional short-term effects of fine particles on hospital admissions in 202 US counties, 1999-2005. *Am J Epidemiol* 2008; **168**(11): 1301-10 <https://pubmed.ncbi.nlm.nih.gov/18854492>.
- Bertels X, Ross JC, Faner R, et al. Clinical relevance of lung function trajectory clusters in middle-aged and older adults. *ERJ Open Res* 2024; **10**(1): <https://pubmed.ncbi.nlm.nih.gov/38333649>.
- Bhakta NR, Bime C, Kaminsky DA, et al. Race and Ethnicity in Pulmonary Function Test Interpretation: An Official American Thoracic Society Statement. *Am J Respir Crit Care Med* 2023; **207**(8): 978-95 <https://pubmed.ncbi.nlm.nih.gov/36973004>.
- Bhatt SP, Rabe KF, Hanania NA, et al. Dupilumab for COPD with Blood Eosinophil Evidence of Type 2 Inflammation. *N Engl J Med* 2024; **390**(24): 2274-83 <https://pubmed.ncbi.nlm.nih.gov/38767614>.
- Boers E, Barrett M, Su JG, et al. Global Burden of Chronic Obstructive Pulmonary Disease Through 2050. *JAMA Netw Open* 2023; **6**(12): e2346598 <https://pubmed.ncbi.nlm.nih.gov/38060225>.
- Bowerman C, Bhakta NR, Brazzale D, et al. A Race-neutral Approach to the Interpretation of Lung Function Measurements. *Am J Respir Crit Care Med* 2023; **207**(6): 768-74 <https://pubmed.ncbi.nlm.nih.gov/36383197>.
- Braga AL, Zanobetti A, Schwartz J. The effect of weather on respiratory and cardiovascular deaths in 12 U.S. cities. *Environ Health Perspect* 2002; **110**(9): 859-63 <https://pubmed.ncbi.nlm.nih.gov/12204818>.
- Britton A, Roper LE, Kotton CN, et al. Use of Respiratory Syncytial Virus Vaccines in Adults Aged \geq 60 Years: Updated Recommendations of the Advisory Committee on Immunization Practices - United States, 2024. *MMWR Morb Mortal Wkly Rep* 2024; **73**(32): 696-702 <https://pubmed.ncbi.nlm.nih.gov/39146277>.
- Burkart KG, Brauer M, Aravkin AY, et al. Estimating the cause-specific relative risks of non-optimal temperature on daily mortality: a two-part modelling approach applied to the Global Burden of Disease Study. *Lancet* 2021; **398**(10301): 685-97 <https://pubmed.ncbi.nlm.nih.gov/34419204>.
- Burton RF, Nevill AM, Stewart AD, Daniell N, Olds T. Statistical approaches to relationships between sitting height and leg length in adults. *Ann Hum Biol* 2013; **40**(1): 64-9 <https://pubmed.ncbi.nlm.nih.gov/23301801>.
- Celli BR, Fabbri LM, Aaron SD, et al. Differential Diagnosis of Suspected Chronic Obstructive Pulmonary Disease Exacerbations in the Acute Care Setting: Best Practice. *Am J Respir Crit Care Med* 2023; **207**(9): 1134-44 <https://pubmed.ncbi.nlm.nih.gov/36701677>.
- Chalmers JD, Laska IF, Franssen FME, et al. Withdrawal of inhaled corticosteroids in COPD: a European Respiratory Society guideline. *Eur Respir J* 2020; **55**(6): <https://pubmed.ncbi.nlm.nih.gov/32366483>.
- Çolak Y, Lange P, Vestbo J, Nordestgaard BG, Afzal S. Susceptible Young Adults and Development of COPD Later in Life. *Am J Respir Crit Care Med* 2024; <https://pubmed.ncbi.nlm.nih.gov/38364200>.
- Çolak Y, Løkke A, Marott JL, et al. Low smoking exposure and development and prognosis of COPD over four decades: A population-based cohort study. *Eur Respir J* 2024; <https://pubmed.ncbi.nlm.nih.gov/38936967>.
- Crisafulli E, Sartori G, Huerta A, et al. Association Between Rome Classification Among Hospitalized Patients With COPD Exacerbations and Short-Term and Intermediate-Term Outcomes. *Chest* 2023; **164**(6): 1422-33 <https://pubmed.ncbi.nlm.nih.gov/37516272>.
- Curriero FC, Heiner KS, Samet JM, Zeger SL, Strug L, Patz JA. Temperature and mortality in 11 cities of the eastern United States. *Am J Epidemiol* 2002; **155**(1): 80-7 <https://pubmed.ncbi.nlm.nih.gov/11772788>.
- Daniels K, Lanes S, Tave A, et al. Risk of Death and Cardiovascular Events Following an Exacerbation of COPD: The EXACOS-CV US Study. *Int J Chron Obstruct Pulmon Dis* 2024; **19**: 225-41 <https://pubmed.ncbi.nlm.nih.gov/38259591>.

- Dauriat G, Reynaud-Gaubert M, Cottin V, et al. Severe pulmonary hypertension associated with chronic obstructive pulmonary disease: A prospective French multicenter cohort. *J Heart Lung Transplant* 2021; **40**(9): 1009-18 <https://pubmed.ncbi.nlm.nih.gov/34218966>.
- Davie GS, Baker MG, Hales S, Carlin JB. Trends and determinants of excess winter mortality in New Zealand: 1980 to 2000. *BMC Public Health* 2007; **7**: 263 <https://pubmed.ncbi.nlm.nih.gov/17892590>.
- De Sario M, Katsouyanni K, Michelozzi P. Climate change, extreme weather events, air pollution and respiratory health in Europe. *Eur Respir J* 2013; **42**(3): 826-43 <https://pubmed.ncbi.nlm.nih.gov/23314896>.
- Delavar MA, Jahani MA, Sepidarkish M, Alidoost S, Mehdinezhad H, Farhadi Z. Relationship between fine particulate matter (PM(2.5)) concentration and risk of hospitalization due to chronic obstructive pulmonary disease: a systematic review and meta-analysis. *BMC Public Health* 2023; **23**(1): 2229 <https://pubmed.ncbi.nlm.nih.gov/37953239>.
- Devereux G, Cotton S, Nath M, et al. Bisoprolol in Patients With Chronic Obstructive Pulmonary Disease at High Risk of Exacerbation: The BICS Randomized Clinical Trial. *Jama* 2024: <https://pubmed.ncbi.nlm.nih.gov/38762800>.
- Diao JA, He Y, Khazanchi R, et al. Implications of Race Adjustment in Lung-Function Equations. *N Engl J Med* 2024; **390**(22): 2083-97 <https://pubmed.ncbi.nlm.nih.gov/38767252>.
- Dicker AJ, Huang JTJ, Lonergan M, et al. The sputum microbiome, airway inflammation, and mortality in chronic obstructive pulmonary disease. *J Allergy Clin Immunol* 2021; **147**(1): 158-67 <https://pubmed.ncbi.nlm.nih.gov/32353489>.
- Donaldson GC, Seemungal T, Jeffries DJ, Wedzicha JA. Effect of temperature on lung function and symptoms in chronic obstructive pulmonary disease. *Eur Respir J* 1999; **13**(4): 844-9.
- Dunican EM, Elicker BM, Henry T, et al. Mucus Plugs and Emphysema in the Pathophysiology of Airflow Obstruction and Hypoxemia in Smokers. *Am J Respir Crit Care Med* 2021; **203**(8): 957-68 <https://pubmed.ncbi.nlm.nih.gov/33180550>.
- Ekström M, Andersson A, Papadopoulos S, et al. Long-Term Oxygen Therapy for 24 or 15 Hours per Day in Severe Hypoxemia. *N Engl J Med* 2024: <https://pubmed.ncbi.nlm.nih.gov/39254466>.
- Evans RA, McAuley H, Harrison EM, et al. Physical, cognitive, and mental health impacts of COVID-19 after hospitalisation (PHOSP-COVID): a UK multicentre, prospective cohort study. *Lancet Respir Med* 2021; **9**(11): 1275-87 <https://pubmed.ncbi.nlm.nih.gov/34627560>.
- Fabbri LM, Celli BR, Agustí A, et al. COPD and multimorbidity: recognising and addressing a syndemic occurrence. *Lancet Respir Med* 2023; **11**(11): 1020-34 <https://pubmed.ncbi.nlm.nih.gov/37696283>.
- Fang YC, Cheng WH, Lu HI, et al. Double lung transplantation is better than single lung transplantation for end-stage chronic obstructive pulmonary disease: a meta-analysis. *J Cardiothorac Surg* 2024; **19**(1): 162 <https://pubmed.ncbi.nlm.nih.gov/38555450>.
- Fieldes M, Bourguignon C, Assou S, et al. Targeted therapy in eosinophilic chronic obstructive pulmonary disease. *ERJ Open Res* 2021; **7**(2): <https://pubmed.ncbi.nlm.nih.gov/33855061>.
- Fischer PH, Brunekreef B, Lebret E. Air pollution related deaths during the 2003 heat wave in the Netherlands. *Atmospheric Environment* 2004; **38**(8): 1083-5.
- Franck U, Krüger M, Schwarz N, Grossmann K, Röder S, Schlink U. Heat stress in urban areas: Indoor and outdoor temperatures in different urban structure types and subjectively reported well-being during a heat wave in the city of Leipzig. *Meteorol Z* 2013; **22**(2): 167-77.
- Fraughen DD, Ghosh AJ, Hobbs BD, et al. Augmentation Therapy for Severe Alpha-1 Antitrypsin Deficiency Improves Survival and Is Decoupled from Spirometric Decline-A Multinational Registry Analysis. *Am J Respir Crit Care Med* 2023; **208**(9): 964-74 <https://pubmed.ncbi.nlm.nih.gov/37624745>.
- Gasparrini A, Guo Y, Hashizume M, et al. Mortality risk attributable to high and low ambient temperature: a multicountry observational study. *Lancet* 2015; **386**(9991): 369-75 <https://pubmed.ncbi.nlm.nih.gov/26003380>.
- GBD Causes of Death Collaborators. Global burden of 288 causes of death and life expectancy decomposition in 204 countries and territories and 811 subnational locations, 1990-2021: a systematic analysis for the Global Burden of Disease Study 2021. *Lancet* 2024; **403**(10440): 2100-32 <https://pubmed.ncbi.nlm.nih.gov/38582094>.
- Glantz SA, Nguyen N, Oliveira da Silva AL. Population-Based Disease Odds for E-Cigarettes and Dual Use versus Cigarettes. *NEJM Evid* 2024; **3**(3): EVID02300229 <https://pubmed.ncbi.nlm.nih.gov/38411454>.
- Global Initiative for Chronic Obstructive Lung Disease (GOLD). Global strategy for the diagnosis, management, and prevention of chronic obstructive pulmonary disease. 2024 Report. <http://www.goldcopd.org/>.
- Graul EL, Nordon C, Rhodes K, et al. Temporal Risk of Nonfatal Cardiovascular Events After Chronic Obstructive Pulmonary Disease Exacerbation: A Population-based Study. *Am J Respir Crit Care Med* 2024; **209**(8): 960-72 <https://pubmed.ncbi.nlm.nih.gov/38127850>.
- Graul EL, Nordon C, Rhodes K, et al. Factors associated with non-fatal heart failure and atrial fibrillation or flutter within the first 30 days post COPD exacerbation: a nested case-control study. *BMC Pulm Med* 2024; **24**(1): 221 <https://pubmed.ncbi.nlm.nih.gov/38704538>.
- Green H, Bailey J, Schwarz L, Vanos J, Ebi K, Benmarhnia T. Impact of heat on mortality and morbidity in low and middle income countries: A review of the epidemiological evidence and considerations for future research. *Environ Res* 2019; **171**: 80-91 <https://pubmed.ncbi.nlm.nih.gov/30660921>.
- Grohskopf LA, Ferdinand JM, Blanton LH, Broder KR, Loehr J. Prevention and Control of Seasonal Influenza with Vaccines: Recommendations of the Advisory Committee on Immunization Practices - United States, 2024-25 Influenza Season. *MMWR Recomm Rep* 2024; **73**(5): 1-25 <https://pubmed.ncbi.nlm.nih.gov/39197095>.

- Gronlund CJ, Zanobetti A, Schwartz JD, Wellenius GA, O'Neill MS. Heat, heat waves, and hospital admissions among the elderly in the United States, 1992-2006. *Environ Health Perspect* 2014; **122**(11): 1187-92 <https://pubmed.ncbi.nlm.nih.gov/24905551>.
- Gu S, Leader J, Zheng B, et al. Direct assessment of lung function in COPD using CT densitometric measures. *Physiol Meas* 2014; **35**(5): 833-45 <https://pubmed.ncbi.nlm.nih.gov/24710855>.
- Hansel NN, McCormack MC, Kim V. The Effects of Air Pollution and Temperature on COPD. *COPD* 2015: 1-8 <https://pubmed.ncbi.nlm.nih.gov/26683097>.
- Hansel NN, McCormack MC, Kim V. The Effects of Air Pollution and Temperature on COPD. *Copd* 2016; **13**(3): 372-9 <https://pubmed.ncbi.nlm.nih.gov/26683097>.
- Hansel NN, Putcha N, Woo H, et al. Randomized Clinical Trial of Air Cleaners to Improve Indoor Air Quality and Chronic Obstructive Pulmonary Disease Health: Results of the CLEAN AIR Study. *Am J Respir Crit Care Med* 2022; **205**(4): 421-30 <https://pubmed.ncbi.nlm.nih.gov/34449285>.
- Hansel NN, Woo H, Koehler K, et al. Indoor Pollution and Lung Function Decline in Current and Former Smokers: SPIROMICS AIR. *Am J Respir Crit Care Med* 2023; **208**(10): 1042-51 <https://pubmed.ncbi.nlm.nih.gov/37523421>.
- Hause AM, Moro PL, Baggs J, et al. Early Safety Findings Among Persons Aged ≥60 Years Who Received a Respiratory Syncytial Virus Vaccine - United States, May 3, 2023-April 14, 2024. *MMWR Morb Mortal Wkly Rep* 2024; **73**(21): 489-94 <https://pubmed.ncbi.nlm.nih.gov/38814851>.
- Hooper MM, Humbert M, Souza R, et al. A global view of pulmonary hypertension. *Lancet Respir Med* 2016; **4**(4): 306-22 <https://pubmed.ncbi.nlm.nih.gov/26975810>.
- Humbert M, Kovacs G, Hooper MM, et al. 2022 ESC/ERS Guidelines for the diagnosis and treatment of pulmonary hypertension. *Eur Heart J* 2022; **43**(38): 3618-731 <https://pubmed.ncbi.nlm.nih.gov/36017548>.
- Humbert M, Kovacs G, Hooper MM, et al. 2022 ESC/ERS Guidelines for the diagnosis and treatment of pulmonary hypertension. *Eur Respir J* 2023; **61**(1): <https://pubmed.ncbi.nlm.nih.gov/36028254>.
- Hurst JR, Gale CP. MACE in COPD: addressing cardiopulmonary risk. *Lancet Respir Med* 2024; **12**(5): 345-8 <https://pubmed.ncbi.nlm.nih.gov/38437859>.
- Ison MG, Papi A, Athan E, et al. Efficacy and Safety of Respiratory Syncytial Virus (RSV) Prefusion F Protein Vaccine (RSVPreF3 OA) in Older Adults Over 2 RSV Seasons. *Clin Infect Dis* 2024; **78**(6): 1732-44 <https://pubmed.ncbi.nlm.nih.gov/38253338>.
- Jacob D, Winner D. Effect of climate change on air quality. *Atmos Environ* 2009; **43**: 51-63.
- Joo H, Yoon HK, Hwang YI, et al. Application of the Lancet Commission COPD classification to COPD Cohort Population in South Korea. *Respir Med* 2024; **230**: 107679 <https://pubmed.ncbi.nlm.nih.gov/38797345>.
- Kayongo A, Robertson NM, Siddharthan T, et al. Airway microbiome-immune crosstalk in chronic obstructive pulmonary disease. *Front Immunol* 2022; **13**: 1085551 <https://pubmed.ncbi.nlm.nih.gov/36741369>.
- Kermelly SB, Bourbeau J. eHealth in Self-Managing at a Distance Patients with COPD. *Life (Basel)* 2022; **12**(6): <https://pubmed.ncbi.nlm.nih.gov/35743804>.
- Ko FW, Tam W, Wong TW, et al. Temporal relationship between air pollutants and hospital admissions for chronic obstructive pulmonary disease in Hong Kong. *Thorax* 2007; **62**(9): 780-5 <https://pubmed.ncbi.nlm.nih.gov/17311838>.
- Kobayashi M, Leidner AJ, Gierke R, et al. Use of 21-Valent Pneumococcal Conjugate Vaccine Among U.S. Adults: Recommendations of the Advisory Committee on Immunization Practices - United States, 2024. *MMWR Morb Mortal Wkly Rep* 2024; **73**(36): 793-8 <https://pubmed.ncbi.nlm.nih.gov/39264843>.
- Kogo M, Sato S, Muro S, et al. Longitudinal Changes and Association of Respiratory Symptoms with Preserved Ratio Impaired Spirometry (PRISm): The Nagahama Study. *Ann Am Thorac Soc* 2023; **20**(11): 1578-86 <https://pubmed.ncbi.nlm.nih.gov/37560979>.
- Kwok WC, Leung SHI, Tam TCC, et al. Efficacy of mRNA and Inactivated Whole Virus Vaccines Against COVID-19 in Patients with Chronic Respiratory Diseases. *Int J Chron Obstruct Pulmon Dis* 2023; **18**: 47-56 <https://pubmed.ncbi.nlm.nih.gov/36698687>.
- Lea S, Higham A, Beech A, Singh D. How inhaled corticosteroids target inflammation in COPD. *Eur Respir Rev* 2023; **32**(170): <https://pubmed.ncbi.nlm.nih.gov/37852657>.
- Li G, Zhou M, Cai Y, Zhang Y, Pan X. Does temperature enhance acute mortality effects of ambient particle pollution in Tianjin City, China. *Sci Total Environ* 2011; **409**(10): 1811-7 <https://pubmed.ncbi.nlm.nih.gov/21376370>.
- Liang C, Chung HF, Dobson A, Sandin S, Weiderpass E, Mishra GD. Female reproductive histories and the risk of chronic obstructive pulmonary disease. *Thorax* 2024: <https://pubmed.ncbi.nlm.nih.gov/38350732>.
- Licskai C, Hussey A, Rowley V, et al. Quantifying sustained health system benefits of primary care-based integrated disease management for COPD: a 6-year interrupted time series study. *Thorax* 2024: <https://pubmed.ncbi.nlm.nih.gov/38889973>.
- Lillebøe HL, Engeset MS, Clemm HH, et al. Expiratory airflow limitation in adults born extremely preterm: A systematic review and meta-analysis. *Paediatr Respir Rev* 2024: <https://pubmed.ncbi.nlm.nih.gov/38490917>.
- Lin S, Luo M, Walker RJ, Liu X, Hwang SA, Chinery R. Extreme high temperatures and hospital admissions for respiratory and cardiovascular diseases. *Epidemiology* 2009; **20**(5): 738-46 <https://pubmed.ncbi.nlm.nih.gov/19593155>.
- ERS CADSET.Lungtracker website. Lung Function Tracker. 2024. https://gli-calculator.ersnet.org/lung_tracker/ [accessed Oct 2024].

- Malinovschi A, Zhou X, Andersson A, et al. Consequences of Using Post- or Prebronchodilator Reference Values in Interpreting Spirometry. *Am J Respir Crit Care Med* 2023; **208**(4): 461-71 <https://pubmed.ncbi.nlm.nih.gov/37339507>.
- Manifield J, Chaudhry Y, Singh SJ, Ward TJC, Whelan ME, Orme MW. Changes in physical activity, sedentary behaviour and sleep following pulmonary rehabilitation: a systematic review and network meta-analysis. *Eur Respir Rev* 2024; **33**(172): <https://pubmed.ncbi.nlm.nih.gov/38599676>.
- Martinez CH, Chen YH, Westgate PM, et al. Relationship between quantitative CT metrics and health status and BODE in chronic obstructive pulmonary disease. *Thorax* 2012; **67**(5): 399-406 <https://pubmed.ncbi.nlm.nih.gov/22514236>.
- Mazdiyasni O, AghaKouchak A, Davis SJ, et al. Increasing probability of mortality during Indian heat waves. *Sci Adv* 2017; **3**(6): e1700066 <https://pubmed.ncbi.nlm.nih.gov/28630921>.
- McCormack MC, Belli AJ, Waugh D, et al. Respiratory Effects of Indoor Heat and the Interaction with Air Pollution in Chronic Obstructive Pulmonary Disease. *Ann Am Thorac Soc* 2016; **13**(12): 2125-31 <https://pubmed.ncbi.nlm.nih.gov/27684429>.
- McCormack MC, Paulin LM, Gummerson CE, Peng RD, Diette GB, Hansel NN. Colder temperature is associated with increased COPD morbidity. *Eur Respir J* 2017; **49**(6): <https://pubmed.ncbi.nlm.nih.gov/28663313>.
- Melén E, Faner R, Allinson JP, et al. Lung-function trajectories: relevance and implementation in clinical practice. *Lancet* 2024; **403**(10435): 1494-503 <https://pubmed.ncbi.nlm.nih.gov/38490231>.
- Mettler SK, Nath HP, Grumley S, et al. Silent Airway Mucus Plugs in COPD and Clinical Implications. *Chest* 2023: <https://pubmed.ncbi.nlm.nih.gov/38013161>.
- Mu Z, Chen PL, Geng FH, et al. Synergistic effects of temperature and humidity on the symptoms of COPD patients. *Int J Biometeorol* 2017: <https://pubmed.ncbi.nlm.nih.gov/28567499>.
- Naeger S, Pool V, Macina D. Increased Burden of Pertussis Among Adolescents and Adults With Asthma or COPD in the United States, 2007 to 2019. *Chest* 2024; **165**(6): 1352-61 <https://pubmed.ncbi.nlm.nih.gov/38128608>.
- Nakano Y, Wong JC, de Jong PA, et al. The prediction of small airway dimensions using computed tomography. *Am J Respir Crit Care Med* 2005; **171**(2): 142-6 <https://pubmed.ncbi.nlm.nih.gov/15516531>.
- Nathan SD, Argula R, Trivieri MG, et al. Inhaled treprostinil in pulmonary hypertension associated with COPD: PERFECT study results. *Eur Respir J* 2024; **63**(6): <https://pubmed.ncbi.nlm.nih.gov/38811045>.
- Neches García V, Vallejo-Aparicio LA, Ismaila AS, et al. Clinical and Economic Impact of Long-Term Inhaled Corticosteroid Withdrawal in Patients with Chronic Obstructive Pulmonary Disease Treated with Triple Therapy in Spain. *Int J Chron Obstruct Pulmon Dis* 2022; **17**: 2161-74 <https://pubmed.ncbi.nlm.nih.gov/36101793>.
- Noh E, Jeong H, Cho IS, et al. Risk of Cardiovascular Events Associated with Chronic Obstructive Pulmonary Disease and/or Metabolic Syndrome: A Large-Scale Nationwide Population-Based Cohort Study. *Int J Chron Obstruct Pulmon Dis* 2024; **19**: 1447-56 <https://pubmed.ncbi.nlm.nih.gov/38948908>.
- Opron K, Begley LA, Erb-Downward JR, et al. Loss of Airway Phylogenetic Diversity Is Associated with Clinical and Pathobiological Markers of Disease Development in Chronic Obstructive Pulmonary Disease. *Am J Respir Crit Care Med* 2024; **210**(2): 186-200 <https://pubmed.ncbi.nlm.nih.gov/38261629>.
- Oshagbemi OA, Franssen FME, van Kraaij S, et al. Blood Eosinophil Counts, Withdrawal of Inhaled Corticosteroids and Risk of COPD Exacerbations and Mortality in the Clinical Practice Research Datalink (CPRD). *Copd* 2019; **16**(2): 152-9 <https://pubmed.ncbi.nlm.nih.gov/31117850>.
- Osman LM, Ayres JG, Garden C, Reglitz K, Lyon J, Douglas JG. Home warmth and health status of COPD patients. *Eur J Public Health* 2008; **18**(4): 399-405 <https://pubmed.ncbi.nlm.nih.gov/18367496>.
- Paixão C, Rocha V, Brooks D, Marques A. Unsupervised physical activity interventions for people with COPD: A systematic review and meta-analysis. *Pulmonology* 2024; **30**(1): 53-67 <https://pubmed.ncbi.nlm.nih.gov/35151622>.
- Pepke-Zaba J, Delcroix M, Lang I, et al. Chronic thromboembolic pulmonary hypertension (CTEPH): results from an international prospective registry. *Circulation* 2011; **124**(18): 1973-81 <https://pubmed.ncbi.nlm.nih.gov/21969018>.
- Phillips DB, James MD, Vincent SG, et al. Physiological Characterization of Preserved Ratio Impaired Spirometry in the CanCOLD Study: Implications for Exertional Dyspnea and Exercise Intolerance. *Am J Respir Crit Care Med* 2024: <https://pubmed.ncbi.nlm.nih.gov/38170674>.
- Pitre T, Abbasi S, Kachkovski GV, et al. Home respiratory strategies in COPD patients with chronic hypercapnic respiratory failure: a systematic review and network meta-analysis. *Respir Care* 2024: <https://pubmed.ncbi.nlm.nih.gov/38569922>.
- Platt H, Omole T, Cardona J, et al. Safety, tolerability, and immunogenicity of a 21-valent pneumococcal conjugate vaccine, V116, in healthy adults: phase 1/2, randomised, double-blind, active comparator-controlled, multicentre, US-based trial. *Lancet Infect Dis* 2023; **23**(2): 233-46 <https://pubmed.ncbi.nlm.nih.gov/36116461>.
- Polverino E, De Soya A, Dimakou K, et al. The Association Between Bronchiectasis and Chronic Obstructive Pulmonary Disease: Data from the European Bronchiectasis Registry (EMBARC). *Am J Respir Crit Care Med* 2024: <https://pubmed.ncbi.nlm.nih.gov/38271696>.
- Pomeroy E, Stock JT, Wells JCK. Population history and ecology, in addition to climate, influence human stature and body proportions. *Sci Rep* 2021; **11**(1): 274 <https://pubmed.ncbi.nlm.nih.gov/33431970>.
- Puzzolo E, Fleeman N, Lorenzetti F, et al. Estimated health effects from domestic use of gaseous fuels for cooking and heating in high-income, middle-income, and low-income countries: a systematic review and meta-analyses. *Lancet Respir Med* 2024: <https://pubmed.ncbi.nlm.nih.gov/38310914>.
- Qiu H, Tan K, Long F, et al. The Burden of COPD Morbidity Attributable to the Interaction between Ambient Air Pollution and Temperature in Chengdu, China. *Int J Environ Res Public Health* 2018; **15**(3): <https://pubmed.ncbi.nlm.nih.gov/29534476>.

- Ramakrishnan S, Jeffers H, Langford-Wiley B, et al. Blood eosinophil-guided oral prednisolone for COPD exacerbations in primary care in the UK (STARR2): a non-inferiority, multicentre, double-blind, placebo-controlled, randomised controlled trial. *Lancet Respir Med* 2024; **12**(1): 67-77 <https://pubmed.ncbi.nlm.nih.gov/37924830>.
- Regan EA, Lowe ME, Make BJ, et al. Early Evidence of Chronic Obstructive Pulmonary Disease Obscured by Race-Specific Prediction Equations. *Am J Respir Crit Care Med* 2024; **209**(1): 59-69 <https://pubmed.ncbi.nlm.nih.gov/37611073>.
- Ren C, Williams GM, Tong S. Does particulate matter modify the association between temperature and cardiorespiratory diseases? *Environ Health Perspect* 2006; **114**(11): 1690-6 <https://pubmed.ncbi.nlm.nih.gov/17107854>.
- Robine JM, Cheung SL, Le Roy S, et al. Death toll exceeded 70,000 in Europe during the summer of 2003. *C R Biol* 2008; **331**(2): 171-8 <https://pubmed.ncbi.nlm.nih.gov/18241810>.
- Rochester CL, Alison JA, Carlin B, et al. Pulmonary Rehabilitation for Adults with Chronic Respiratory Disease: An Official American Thoracic Society Clinical Practice Guideline. *Am J Respir Crit Care Med* 2023; **208**(4): e7-e26 <https://pubmed.ncbi.nlm.nih.gov/37581410>.
- Rocklöv J, Ebi K, Forsberg B. Mortality related to temperature and persistent extreme temperatures: a study of cause-specific and age-stratified mortality. *Occup Environ Med* 2011; **68**(7): 531-6 <https://pubmed.ncbi.nlm.nih.gov/20962034>.
- Scheerens C, Nurhussien L, Aglan A, et al. The impact of personal and outdoor temperature exposure during cold and warm seasons on lung function and respiratory symptoms in COPD. *ERJ Open Res* 2022; **8**(1): <https://pubmed.ncbi.nlm.nih.gov/35295231>.
- Schiavi E, Ryu MH, Martini L, et al. Application of the ERS/ATS Spirometry Standards and Race-Neutral Equations in the COPDGene Study. *Am J Respir Crit Care Med* 2024: <https://pubmed.ncbi.nlm.nih.gov/38607551>.
- Schwartz J. Who is sensitive to extremes of temperature?: A case-only analysis. *Epidemiology* 2005; **16**(1): 67-72 <https://pubmed.ncbi.nlm.nih.gov/15613947>.
- Schwartz J. How sensitive is the association between ozone and daily deaths to control for temperature? *Am J Respir Crit Care Med* 2005; **171**(6): 627-31 <https://pubmed.ncbi.nlm.nih.gov/15579726>.
- Semenza JC, Rubin CH, Falter KH, et al. Heat-related deaths during the July 1995 heat wave in Chicago. *N Engl J Med* 1996; **335**(2): 84-90 <https://pubmed.ncbi.nlm.nih.gov/8649494>.
- Singh D, Han MK, Hawkins NM, et al. Implications of Cardiopulmonary Risk for the Management of COPD: A Narrative Review. *Adv Ther* 2024; **41**(6): 2151-67 <https://pubmed.ncbi.nlm.nih.gov/38664329>.
- Singh D, Lea S, Mathioudakis AG. Inhaled Phosphodiesterase Inhibitors for the Treatment of Chronic Obstructive Pulmonary Disease. *Drugs* 2021; **81**(16): 1821-30 <https://pubmed.ncbi.nlm.nih.gov/34731461>.
- Song Z, Meng Y, Fricker M, et al. The role of gut-lung axis in COPD: Pathogenesis, immune response, and prospective treatment. *Helyon* 2024; **10**(9): e30612 <https://pubmed.ncbi.nlm.nih.gov/38742057>.
- Stafoggia M, Michelozzi P, Schneider A, et al. Joint effect of heat and air pollution on mortality in 620 cities of 36 countries. *Environ Int* 2023; **181**: 108258 <https://pubmed.ncbi.nlm.nih.gov/37837748>.
- Stanojevic S, Kaminsky DA, Miller MR, et al. ERS/ATS technical standard on interpretive strategies for routine lung function tests. *Eur Respir J* 2022; **60**(1): <https://pubmed.ncbi.nlm.nih.gov/34949706>.
- Stedman JR. The predicted number of air pollution related deaths in the UK during the August 2003 heatwave. *Atmospheric Environment* 2004; **38**(8): 1087-90
- Subramanian A, Nirantharakumar K, Hughes S, et al. Symptoms and risk factors for long COVID in non-hospitalized adults. *Nat Med* 2022; **28**(8): 1706-14 <https://pubmed.ncbi.nlm.nih.gov/35879616>.
- Suissa S, Dell'Aniello S, Ernst P. Discontinuation of Inhaled Corticosteroids from Triple Therapy in COPD: Effects on Major Outcomes in Real World Clinical Practice. *Copd* 2022; **19**(1): 133-41 <https://pubmed.ncbi.nlm.nih.gov/35392746>.
- Sulaiman I, Wu BG, Chung M, et al. Lower Airway Dysbiosis Augments Lung Inflammatory Injury in Mild-to-Moderate Chronic Obstructive Pulmonary Disease. *Am J Respir Crit Care Med* 2023; **208**(10): 1101-14 <https://pubmed.ncbi.nlm.nih.gov/37677136>.
- Surie D, Self WH, Zhu Y, et al. RSV Vaccine Effectiveness Against Hospitalization Among US Adults 60 Years and Older. *Jama* 2024; **332**(13): 1105-7 <https://pubmed.ncbi.nlm.nih.gov/39230920>.
- Tamerius J, Perzanowski M, Acosta L, et al. Socioeconomic and Outdoor Meteorological Determinants of Indoor Temperature and Humidity in New York City Dwellings. *Weather Clim Soc* 2013; **5**(2): 168-79 <https://pubmed.ncbi.nlm.nih.gov/24077420>.
- Tan J, Zheng Y, Song G, Kalkstein LS, Kalkstein AJ, Tang X. Heat wave impacts on mortality in Shanghai, 1998 and 2003. *Int J Biometeorol* 2007; **51**(3): 193-200 <https://pubmed.ncbi.nlm.nih.gov/17039379>.
- Tan J, Zheng Y Fau - Tang X, Tang X Fau - Guo C, et al. The urban heat island and its impact on heat waves and human health in Shanghai. (1432-1254 (Electronic)):
- Teare J, Mathee A, Naicker N, et al. Dwelling Characteristics Influence Indoor Temperature and May Pose Health Threats in LMICs. *Ann Glob Health* 2020; **86**(1): 91 <https://pubmed.ncbi.nlm.nih.gov/32832385>.
- Thabut G, Dauriat G, Stern JB, et al. Pulmonary hemodynamics in advanced COPD candidates for lung volume reduction surgery or lung transplantation. *Chest* 2005; **127**(5): 1531-6 <https://pubmed.ncbi.nlm.nih.gov/15888824>.
- The Eurowinter Group. Cold exposure and winter mortality from ischaemic heart disease, cerebrovascular disease, respiratory disease, and all causes in warm and cold regions of Europe. . *Lancet* 1997; **349**(9062): 1341-6 <https://pubmed.ncbi.nlm.nih.gov/9149695>.
- Tseng CM, Chen YT, Ou SM, et al. The effect of cold temperature on increased exacerbation of chronic obstructive pulmonary disease: a nationwide study. *PLoS ONE* 2013; **8**(3): e57066 <https://pubmed.ncbi.nlm.nih.gov/23554858>.

- Verberkt CA, van den Beuken-Everdingen MHJ, Schols J, Wouters EFM, Janssen DJA. Morphine for chronic breathlessness in COPD: improvement predictors-cross-sectional study. *BMJ Support Palliat Care* 2024; **13**(e3): e829-e32 <https://pubmed.ncbi.nlm.nih.gov/35850961>.
- Viggers H, Howden-Chapman P, Ingham T, et al. Warm homes for older people: aims and methods of a randomised community-based trial for people with COPD. *BMC Public Health* 2013; **13**: 176 <https://pubmed.ncbi.nlm.nih.gov/23442368>.
- Vizza CD, Hoeper MM, Huscher D, et al. Pulmonary Hypertension in Patients With COPD: Results From the Comparative, Prospective Registry of Newly Initiated Therapies for Pulmonary Hypertension (COMPERA). *Chest* 2021; **160**(2): 678-89 <https://pubmed.ncbi.nlm.nih.gov/33581097>.
- Vogelmeier CF, Rhodes K, Garbe E, et al. Elucidating the risk of cardiopulmonary consequences of an exacerbation of COPD: results of the EXACOS-CV study in Germany. *BMJ Open Respir Res* 2024; **11**(1): <https://pubmed.ncbi.nlm.nih.gov/38555102>.
- Vogelmeier CF, Worth H, Buhl R, Criée CP, Gückel E, Kardos P. Impact of switching from triple therapy to dual bronchodilation in COPD: the DACCORD 'real world' study. *Respir Res* 2022; **23**(1): 109 <https://pubmed.ncbi.nlm.nih.gov/35501806>.
- Wallace LA, Emmerich SJ, Howard-Reed C. Continuous measurements of air change rates in an occupied house for 1 year: the effect of temperature, wind, fans, and windows. *J Expo Anal Environ Epidemiol* 2002; **12**(4): 296-306 <https://pubmed.ncbi.nlm.nih.gov/12087436>.
- Wang RJ. Beyond Race-Specific Spirometry Reference Equations: What Comes Next? *Am J Respir Crit Care Med* 2024; **209**(1): 117-8 <https://pubmed.ncbi.nlm.nih.gov/37595271>.
- Wang Z, Bafadhel M, Haldar K, et al. Lung microbiome dynamics in COPD exacerbations. *Eur Respir J* 2016; **47**(4): 1082-92 <https://pubmed.ncbi.nlm.nih.gov/26917613>.
- Wang Z, Locantore N, Haldar K, et al. Inflammatory Endotype-associated Airway Microbiome in Chronic Obstructive Pulmonary Disease Clinical Stability and Exacerbations: A Multicohort Longitudinal Analysis. *Am J Respir Crit Care Med* 2021; **203**(12): 1488-502 <https://pubmed.ncbi.nlm.nih.gov/33332995>.
- White-Newsome JL, Sánchez BN, Jolliet O, et al. Climate change and health: indoor heat exposure in vulnerable populations. *Environ Res* 2012; **112**: 20-7 <https://pubmed.ncbi.nlm.nih.gov/22071034>.
- Wilkinson P, Landon M, Armstrong B, Stevenson S, McKee M. Cold comfort: the social and environmental determinants of excess winter death in England, 1986-1996. York: Joseph Rowntree Foundation; 2001.
- Wiseman DJ, Thwaites RS, Ritchie AI, et al. RSV-related Community COPD Exacerbations and Novel Diagnostics: A Binational Prospective Cohort Study. *Am J Respir Crit Care Med* 2024; <https://pubmed.ncbi.nlm.nih.gov/38502541>.
- Wong CM, Ma S, Hedley AJ, Lam TH. Effect of air pollution on daily mortality in Hong Kong. *Environ Health Perspect* 2001; **109**(4): 335-40 <https://pubmed.ncbi.nlm.nih.gov/11335180>.
- Woodruff RC, Melgar M, Pham H, et al. Acute Cardiac Events in Hospitalized Older Adults With Respiratory Syncytial Virus Infection. *JAMA Intern Med* 2024; **184**(6): 602-11 <https://pubmed.ncbi.nlm.nih.gov/38619857>.
- World Health Organisation (WHO). WHO Housing and Health Guidelines. Executive summary. Geneva: World Health Organization; 2018.
- World Health Organisation (WHO). Heat and Health. Geneva: World Health Organisation; 2018.
- Ye X, Wolff R, Yu W, Vaneckova P, Pan X, Tong S. Ambient temperature and morbidity: a review of epidemiological evidence. *Environ Health Perspect* 2012; **120**(1): 19-28 <https://pubmed.ncbi.nlm.nih.gov/21824855>.
- Yoon L, Richardson GRA, Gorman M. Reflections on a Century of Extreme Heat Event-Related Mortality Reporting in Canada. *Geohealth* 2024; **8**(2): e2023GH000895 <https://pubmed.ncbi.nlm.nih.gov/38371353>.
- Yu Y, Xiao W, Du LY, et al. Acupuncture for dyspnea and breathing physiology in chronic respiratory diseases: A systematic review and meta-analysis of randomized controlled trials. *Heliyon* 2024; **10**(10): e31176 <https://pubmed.ncbi.nlm.nih.gov/38813170>.
- Zahhar JA, Salamatullah HK, Almutairi MB, et al. Influenza vaccine effect on risk of stroke occurrence: a systematic review and meta-analysis. *Front Neurol* 2023; **14**: 1324677 <https://pubmed.ncbi.nlm.nih.gov/38269000>.
- Zanobetti A, Schwartz J. Temperature and mortality in nine US cities. *Epidemiology* 2008; **19**(4): 563-70 <https://pubmed.ncbi.nlm.nih.gov/18467963>.
- Zeder K, Avian A, Bachmaier G, et al. Elevated pulmonary vascular resistance predicts mortality in COPD patients. *The European respiratory journal* 2021;
- Zhang Y, Huang W, London SJ, et al. Ozone and daily mortality in Shanghai, China. *Environ Health Perspect* 2006; **114**(8): 1227-32 <https://pubmed.ncbi.nlm.nih.gov/16882530>.
- Zhou L, Yang H, Zhang Y, et al. Predictive value of lung function measures for cardiovascular risk: a large prospective cohort study. *Thorax* 2024; **79**(3): 250-8 <https://pubmed.ncbi.nlm.nih.gov/38050152>.