

## dr. Pandu Tridana Sakti Sp.PD

Mataram, 1 September 1993

**Internist at Royal Progress Hospital, Sunter  
(Monday-Saturday 17.00-21.00)**

### Educational Background :

- Internal Medicine Specialist, Brawijaya University

### International Congress :

- World Congress of Nephrology, Canada, 2021
- Asia-Pacific League of Associations For Rheumatology Congress, Hong Kong, 2022

### Scientific Publications :

- Intercontinental Cooperative Non-Hodgkin T-Cell Lymphoma Prospective Registry Study in Asia: ICT Study. Samsung Medical Center (2018).
- Five-Year Survival Rate of Patients with End-Stage Renal Disease on CAPD at Malang CAPD Center, Indonesia. Acta Medica Indonesiana Journal (2023).
- Effects of Candesartan-Losartan on Inhibiting Mesangial Expansion in Diabetic Rats Receiving Rosmarinic Acid. Nephrology Dialysis Transplantation Journal (2023).
- Delayed Diagnosis of Takayasu Arteritis as an Etiology of Recurrent Ischemic Stroke Attack. International Journal of Rheumatic Diseases (2023).
- Case Series of Delayed Diagnosis Adult Onset Still's Disease: Diagnostic Dilemma in Positive ANA and TB Areas. Modern Rheumatology Case Reports (2023).
- Risk Factor Analysis for GERD in COVID-19 Pandemic Era on Resident Physicians of Faculty Medicine Brawijaya University. Jurnal Penyakit Dalam Indonesia (2022)
- Five Years Survival Rate of CAPD in ESRD in Indonesia: Can CAPD be A Solution for ESRD in Low Income Country??. Kidney International Report Journal (2021)
- Iron Deficiency Anemia as The Only Manifestation of Colon Cancer in Male Patient. The Indonesian Journal of Gastroenterology, Hepatology (2020)
- Buku Ajar Tuberkulosis Ekstra Paru. FK UI-RSCM (2018).
- Buku Ajar Perioperatif Pada Geriatri, Ismaya Publishing (2023).
- Hak Kekayaan Intelektual "Alur Sistem Rujukan Untuk Pasien Lupus Eritematosus Sistemik (LES) di Malang Raya. Kementerian Hukum dan HAM RI, 2021.





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**ROYAL PROGRESS**  
*Melayani dengan Penuh Cinta Kasih*

# **AIR POLLUTION AND HUMAN HEALTH**

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## Health Issues – Air Pollution



**Air pollution is responsible for 6.7 million premature deaths every year**

**89% in low- and middle-income countries  
The greatest number in South-East Asia and Western Pacific**

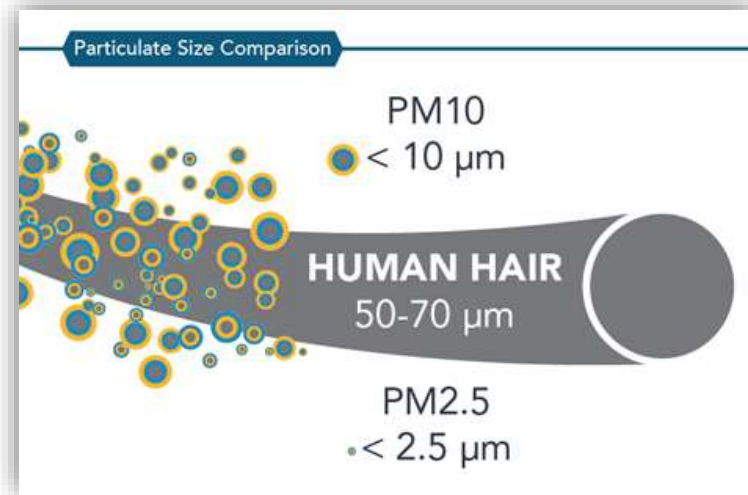
**In Indonesia : BPJS burden for health costs due to  
Respiratory disease increases significantly**

# Pollutant

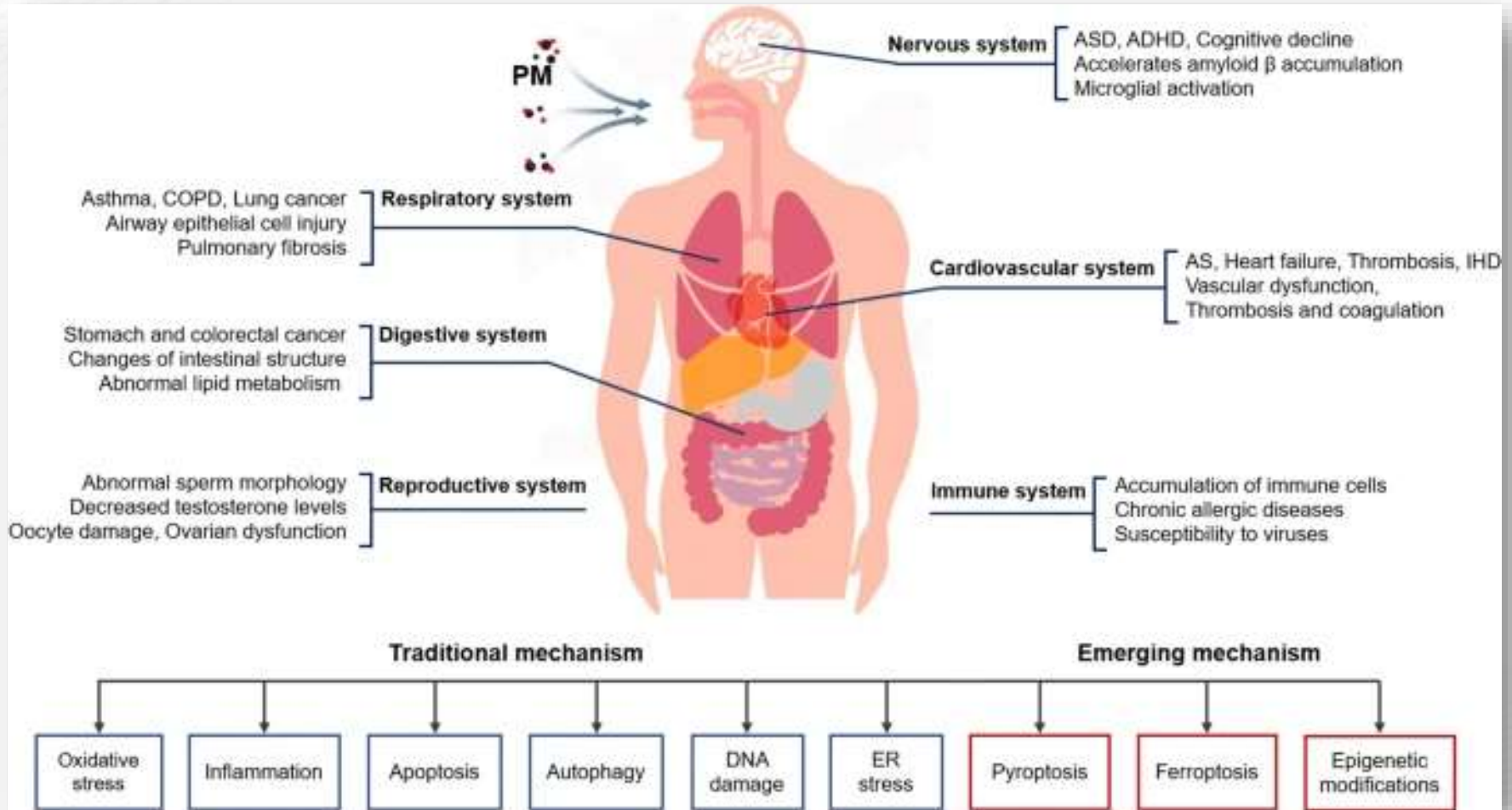
- **Particulate matter (PM)**  
PM is a common indicator for air pollution. Major components : sulfates, nitrates, ammonia, sodium chloride, black carbon, mineral dust and water.
- **Carbon monoxide (CO)**  
CO is a **colourless, odourless and tasteless toxic gas** produced by the incomplete combustion of carbonaceous fuels such as wood, petrol, charcoal, natural gas
- **Ozone (O<sub>3</sub>)**  
Ozone at ground level is photochemical smog and it is formed through the reaction with gases and sunlight.
- **Nitrogen dioxide (NO<sub>2</sub>)**  
NO<sub>2</sub> is from the combustion of fuels in the transportation and industrial sectors.
- **Sulfur dioxide (SO<sub>2</sub>)**  
SO<sub>2</sub> is a **colourless gas with a sharp odour**. It is produced from the burning of fossil fuels (coal and oil) and the smelting of mineral ores that contain sulfur.

# PM<sub>2.5</sub>

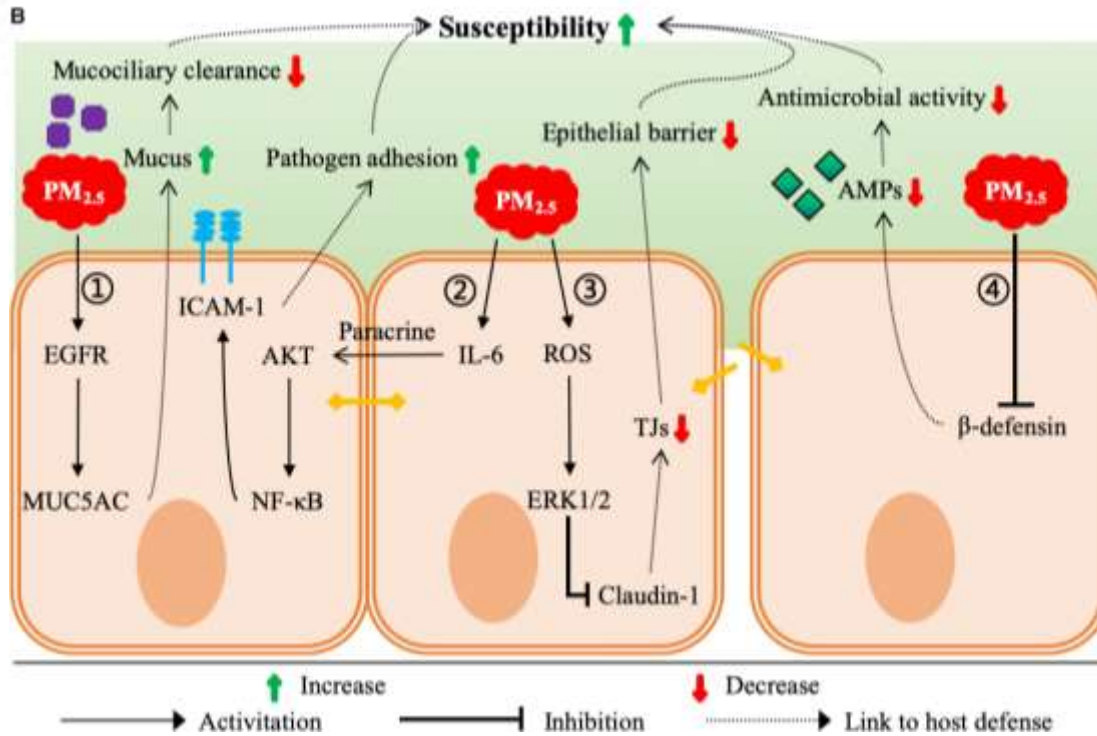
- **Particulate Matter (PM<sub>2.5</sub>)** adalah partikel udara yang berukuran <2.5  $\mu\text{m}$ .
- Pengukuran konsentrasi PM<sub>2.5</sub> → metode penyinaran sinar Beta (Beta Attenuation Monitoring) dengan satuan  $\mu\text{g}/\text{m}^3$ .



# Disease Related PM<sub>2.5</sub>



# Respiratory Problem



ISPA, Pneumonia

Asma, Alergi

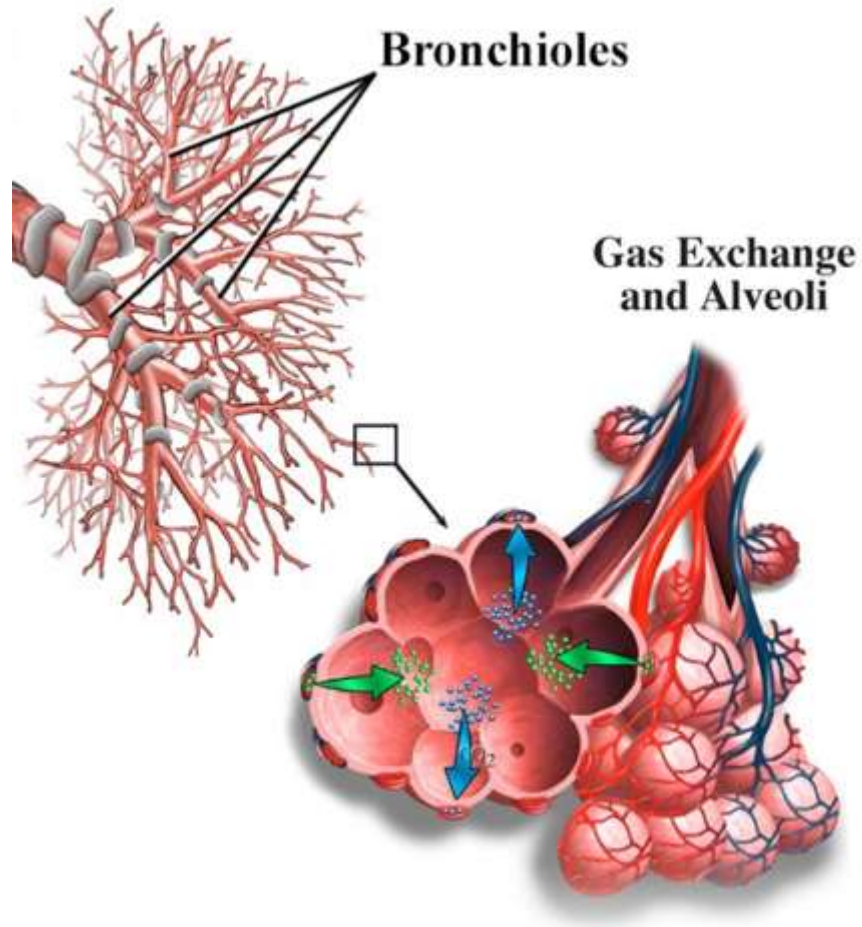
PPOK

Kanker Paru

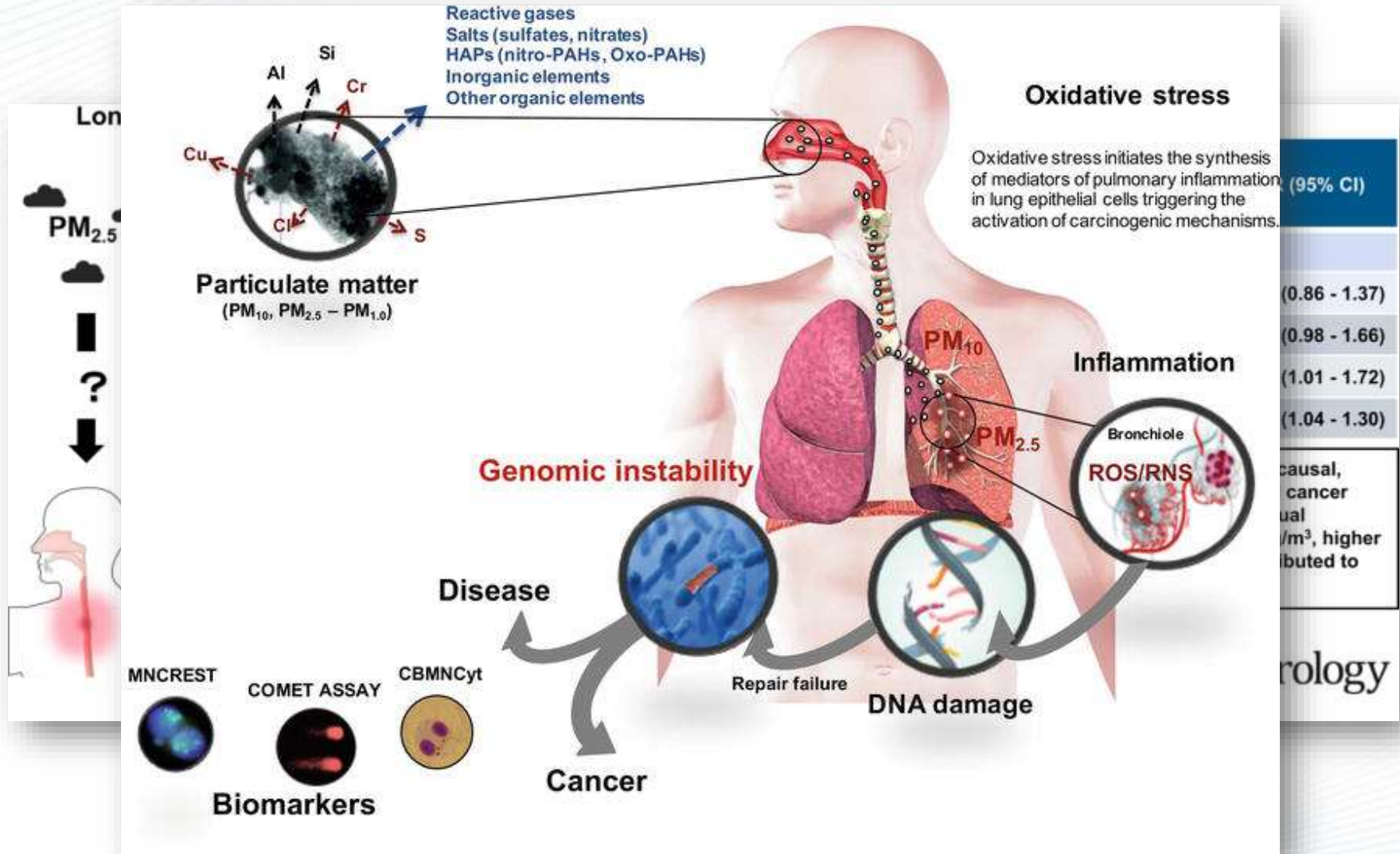


# Cardio-Cerebrovascular Problem

Dirgawati et al. 2019 [132]	The Health in Men Study (HIMS)	Apr 1996–Jan 1999	12,203 participants	≥65 years	Perth	5	Fatal: Stroke.
Heritier et al. 2019 [133]	Swiss National Cohort (SNC)	Dec 2000–Dec 2008	7.28 million observations	>30 years	Switzerland	10	Mortality: AMI (1.034, 95% CI: 1.014–1.055).
Huang et al. 2019	China-PAR	2000–2015	117,575 participants	<50 years >50 years	China	10	Incident: Stroke (13% (1.133, 1.09 to 1.17)).
Hayes et al. 2020 [139]	National Institutes of Health NIH-AARP	2000–2005	565,477 participants	50–71 years	U.S. states (California, Florida, Louisiana, New Jersey, North Carolina, and Pennsylvania) and urban areas (Atlanta, GA, and Detroit, MI.)	10	Mortality: IHD (HR 1.16; 95% CI 1.09–1.22) and Stroke (HR 1.14; CI 1.02–1.27).
Ljungman et al. 2019 [136]	Swedish cohorts (includes the Primary Prevention Study (PPS) and the Multinational Monitoring of Trends and Determinants in Cardiovascular Diseases (GOT-MONICA)	Jan 1990–Dec 2011	114,758 individuals	25–64 years	Sweden-Gothenburg, Stockholm, and Umea	1,94	Incident: IHD (6.5% (95% CI: -0.5–0.5, 14)).
Pope et al. 2019 [137]	National Health Interview Surveys (NHIS)	1986–2014	1,599,329 participants	18–64 years	U.S.	10	Mortality: CP (1.24 (95% CI: 1.20, 1.29)) and (1.23 (95% CI: 1.17, 1.29)).
Shin et al. 2019 [138]	Ontario Population Health and Environment Cohort (ONPHEC)	Apr 2001–Mar 2015	5,071,956 participants	35–85 years	Canada-Ontario	10	AF: HR (95% CI): 1.03 (1.01, 1.04) and Incidence: Stroke (HR (95% CI): 1.05 (1.03, 1.07)).
Hayes et al. 2020 [139]	National Institutes of Health NIH-AARP	2000–2005	565,477 participants	50–71 years	U.S. states (California, Florida, Louisiana, New Jersey, North Carolina, and Pennsylvania) and urban areas (Atlanta, GA, and Detroit, MI.)	10	Mortality: IHD (HR 1.16; 95% CI 1.09–1.22) and Stroke (HR 1.14; CI 1.02–1.27).



# Cancer Risk



• ESPITIA-PÉREZ, Lyda; JIMÉNEZ-VIDAL, Luisa; ESPITIA-PÉREZ, Pedro. Particulate Matter Exposure: Genomic Instability, Disease, and Cancer Risk. In: *Environmental Health-Management and Prevention Practices*. IntechOpen, 2019.  
• Sun, D., Liu, C., Zhu, Y., Yu, C., Guo, Y., Sun, D., Pang, Y., Pei, P., Du, H., Yang, L. and Chen, Y., 2023. Long-Term Exposure to Fine Particulate Matter and Incidence of Esophageal Cancer: A Prospective Study of 0.5 Million Chinese Adults. *Gastroenterology*.

# Diabetes Risk

## Insulin resistance/diabetes

The association between insulin resistance and type 2 diabetes has been reviewed in prior expert reviews 6, 7, 64, 65. In a meta-analysis of cohort studies involving a total of 2,371,907 participants and 21,095 incident cases of type 2 diabetes mellitus, the relative risk for diabetes increased by 39% per 10  $\mu\text{g}/\text{m}^3$  of  $\text{PM}_{2.5}$  (66). In a recent meta-analysis (13 studies),  **$\text{PM}_{2.5}$  and  $\text{NO}_2$  increased the risk of diabetes** (HR: 1.10; 95% CI: 1.02 to 1.18 and HR: 1.08; 95% CI: 1.00 to 1.17 per 10  $\mu\text{g}/\text{m}^3$  increase in  $\text{PM}_{2.5}$  and  $\text{NO}_2$ , respectively)

# Health Prevention



				
<b>HyperHEPA Filtration Technology</b>	<b>High-efficiency particulate air (HEPA) filters</b>	<b>Ozone generators</b>	<b>Air ionizers</b>	<b>Ultraviolet (UV) light air purifiers</b>
Highest performance filter, tested and certified to exceed stringent HEPA filtration standards	A dense fiber filter traps pollutants	Ozone molecules are released to oxidize pollutants	Ions are released to attach to pollutants and then stick to surfaces	UV light impairs the DNA of live pollutants

**THANK YOU**