



ÇEV 806
Hava Kirliliđi ve İklim Deđiřimi

3 - Hava Kirliliđinin Etkileri

Doç. Dr. Özgür ZEYDAN

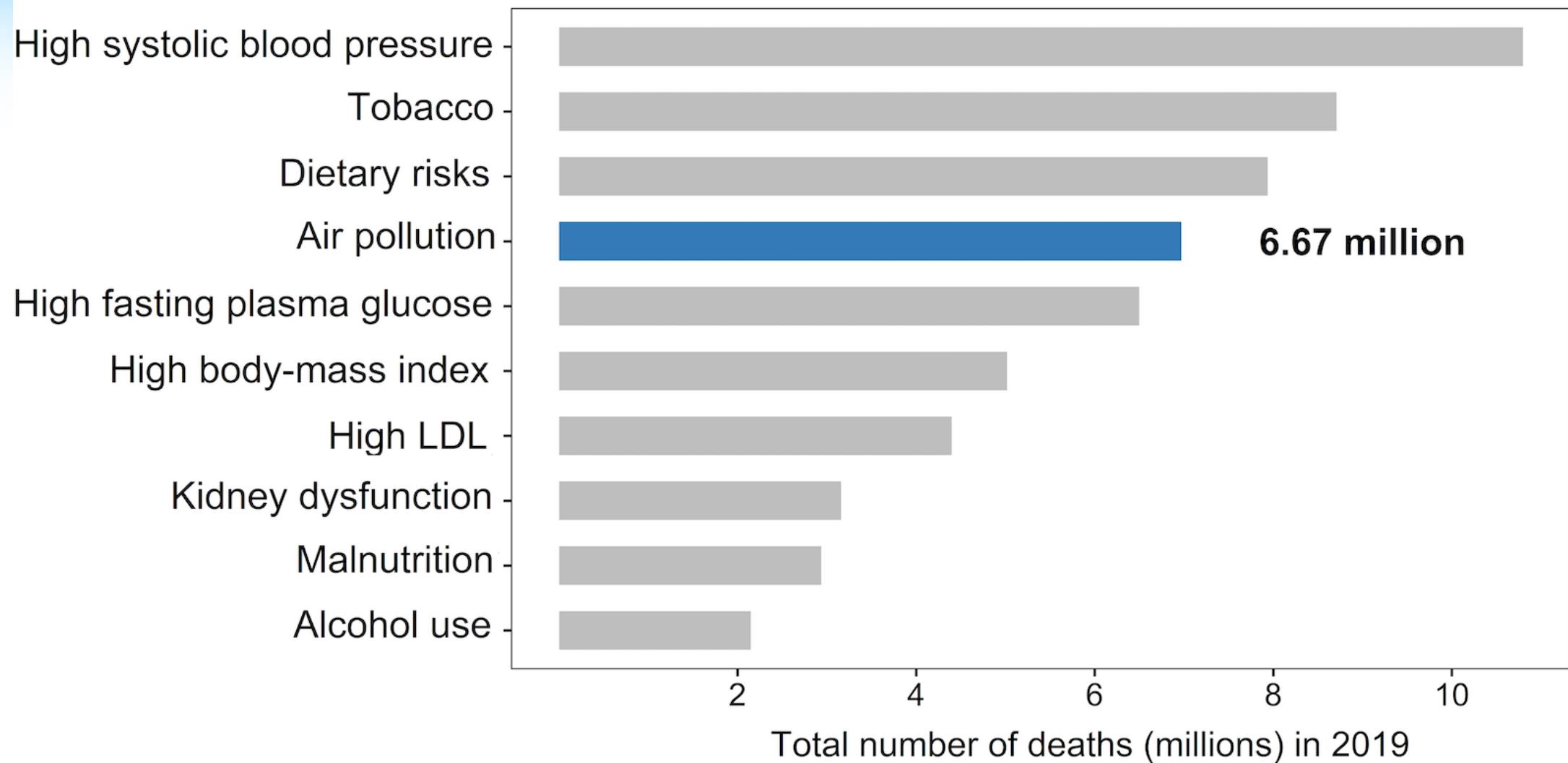
<https://ozgurzeydan.com.tr/>

Hava Kirleticileri ve Etkileri

Etkiler	Kirleticiler	NH ₃	SO ₂	NO _x	NMVOC	CO	PM _{2.5}	CO ₂	CH ₄	N ₂ O	Ağır metaller	Benzen
Yer seviyesi Ozonu				++	++	++						
Asidifikasyon		++	++	++								
Ötrofikasyon		++		++								
Kentsel hava kalitesi						+	++				+	++
Toprak kirliliği											++	
Görüş seviyesinde azalma							++					
Aerosol oluşumu		++	++	++	++		++					
Sera etkisinin kuvvetlenmesi								++	+	+		

+ : orta seviyede etki

++ : kuvvetli etki



Kısa süreli maruziyete atfedilen etkiler

- Günlük mortalite
- Solunum ve kardiyovasküler hastane başvuruları
- Solunum ve kardiyovasküler acil servis ziyaretleri
- Solunum ve kardiyovasküler birinci basamak bakım ziyaretleri
- Solunum ve kardiyovasküler ilaçların kullanımı
- Kısıtlı etkinlik günleri
- İş devamsızlığı
- Okul devamsızlığı
- Akut semptomlar (hırıltı, öksürük, balgam üretimi, solunum yolu enfeksiyonları)
- Fizyolojik değişiklikler (örn. akciğer fonksiyonu)

Uzun süreli maruziyete atfedilen etkiler

- Kardiyovasküler ve solunum yolu hastalığına bağlı ölüm oranı
- Kronik solunum yolu hastalığı insidansı ve prevalansı (astım, KOAH, kronik patolojik değişiklikler)
- Fizyolojik fonksiyonlarda kronik değişiklikler
- Akciğer kanseri
- Kronik kardiyovasküler hastalık
- Rahim içi büyüme kısıtlaması (dönemde düşük doğum ağırlığı, rahim içi büyüme geriliği, gebelik yaşına göre küçük)

Hava kirliliğinin sağlığa etkileri

Hava kirlleticilerin insan sağlığına ciddi etkisi olabilir. Çocuklar ve yaşlılar özellikle riskli gruptadır.

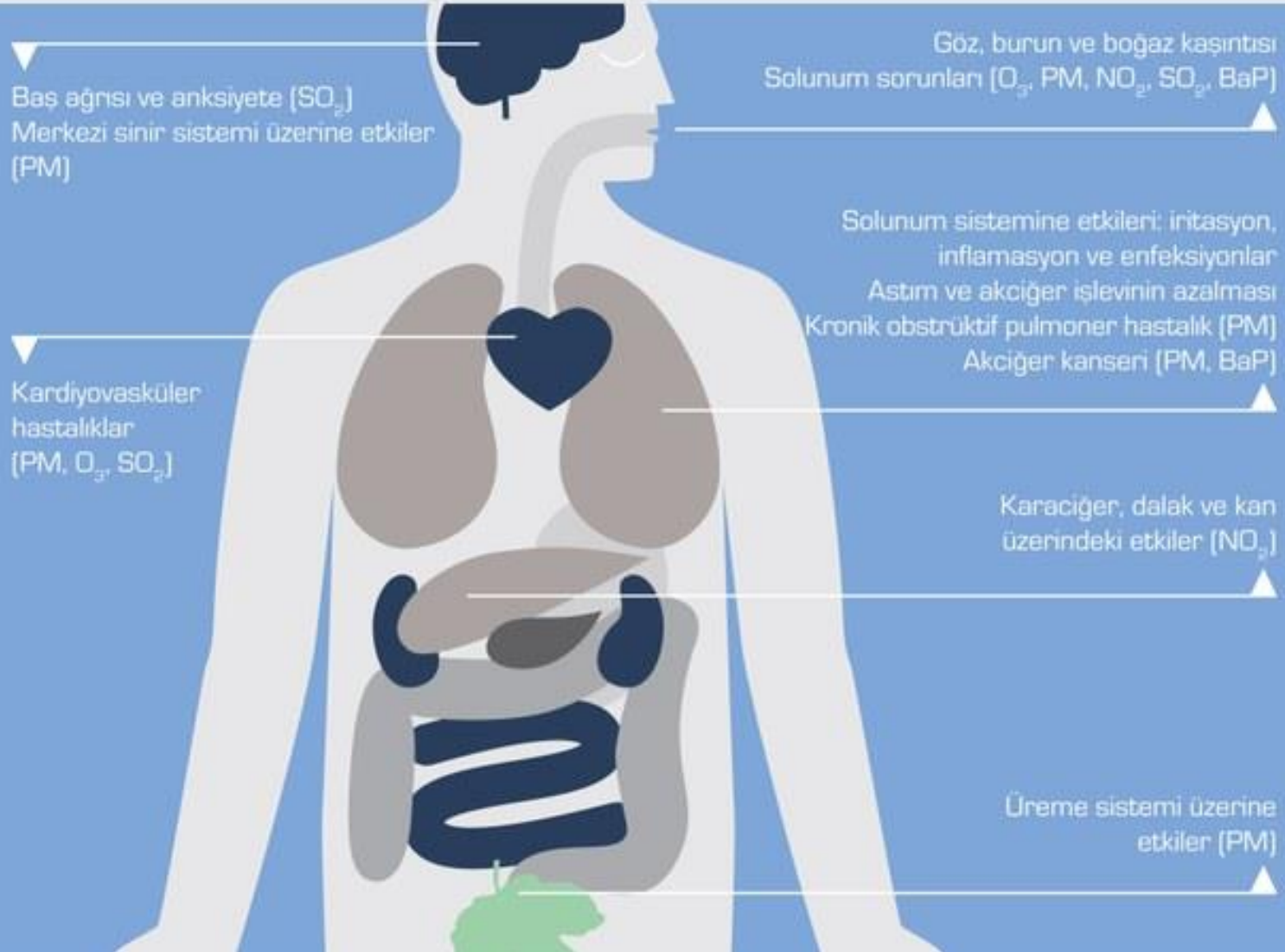
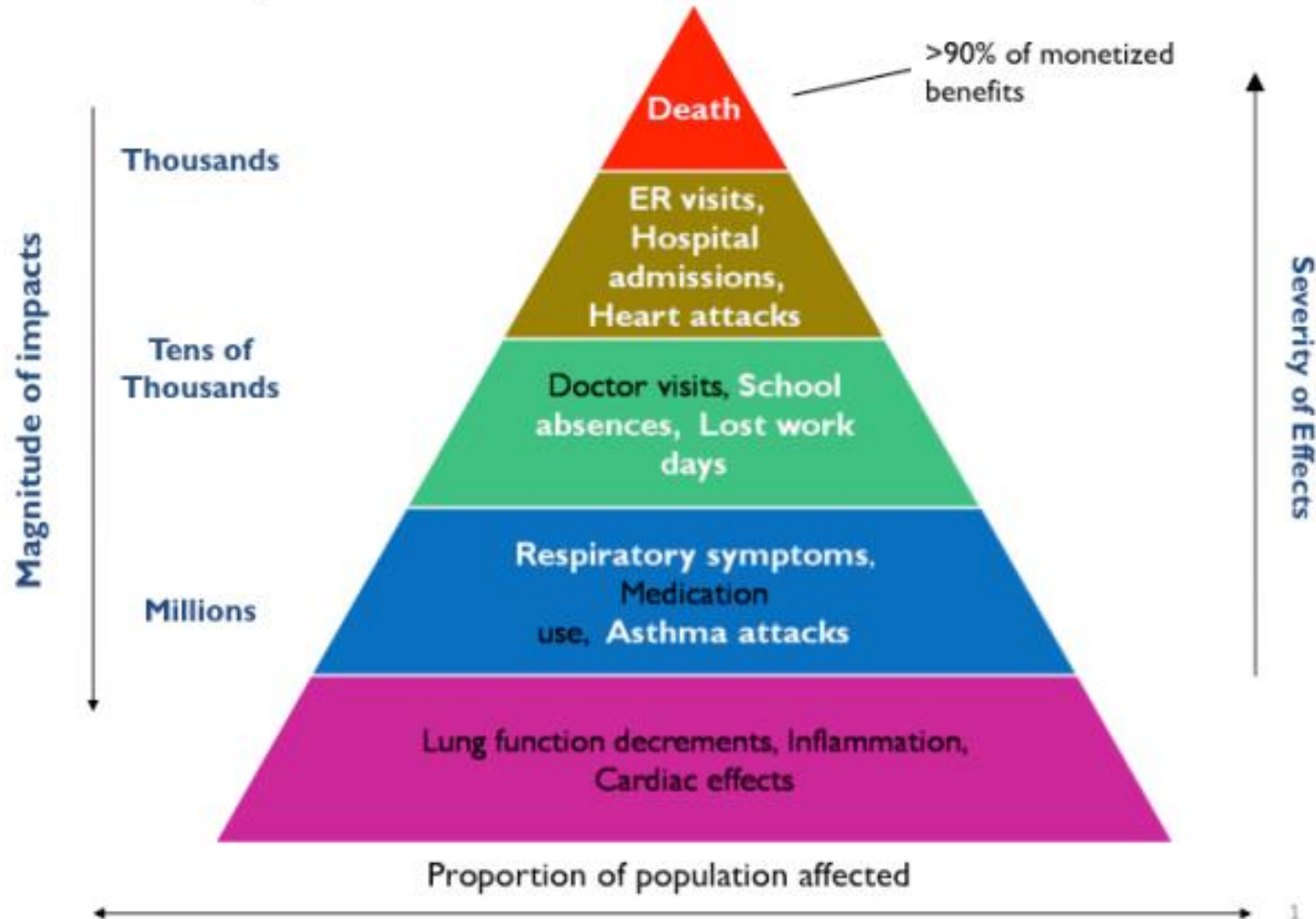


Table A1.1 Quantified impacts for the major regional pollutants

Burden	Effect
Human exposure to PM _{2.5}	Chronic effects on: Mortality Adults over 30 years Infants Morbidity Bronchitis Acute effects on: Morbidity Respiratory hospital admissions Cardiac hospital admissions Consultations with primary care physicians Restricted activity days Use of respiratory medication Symptom days
Human exposure to ozone	Acute effects on: Mortality Morbidity Respiratory hospital admissions Minor restricted activity days Use of respiratory medication Symptom days
Exposure of crops to ozone	Yield loss for: barley, cotton, fruit, grape, hops, millet, maize, oats, olive, potato, pulses, rapeseed, rice, rye, seed cotton, soybean, sugar beet, sunflower seed, tobacco, wheat
SO ₂ effects on utilitarian buildings	Degradation of stone and metalwork, particularly zinc, galvanised steel

Pyramid of health effects associated with air pollution

A "Pyramid of Effects" from Air Pollution



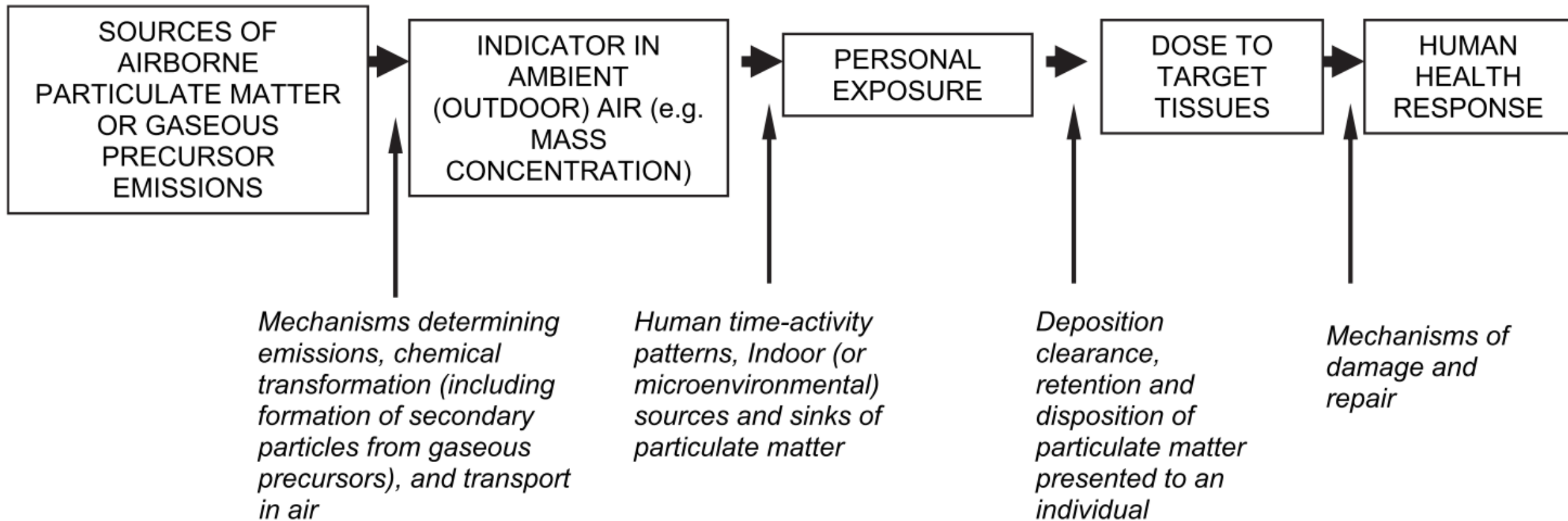


FIG. 1. NRC five-stage framework for integrating particulate matter research (NRC, 1998).

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Health Effects Associated With Exposure to Ambient Air Pollution

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<https://www.tandfonline.com/doi/full/10.1080/15287390600884644>

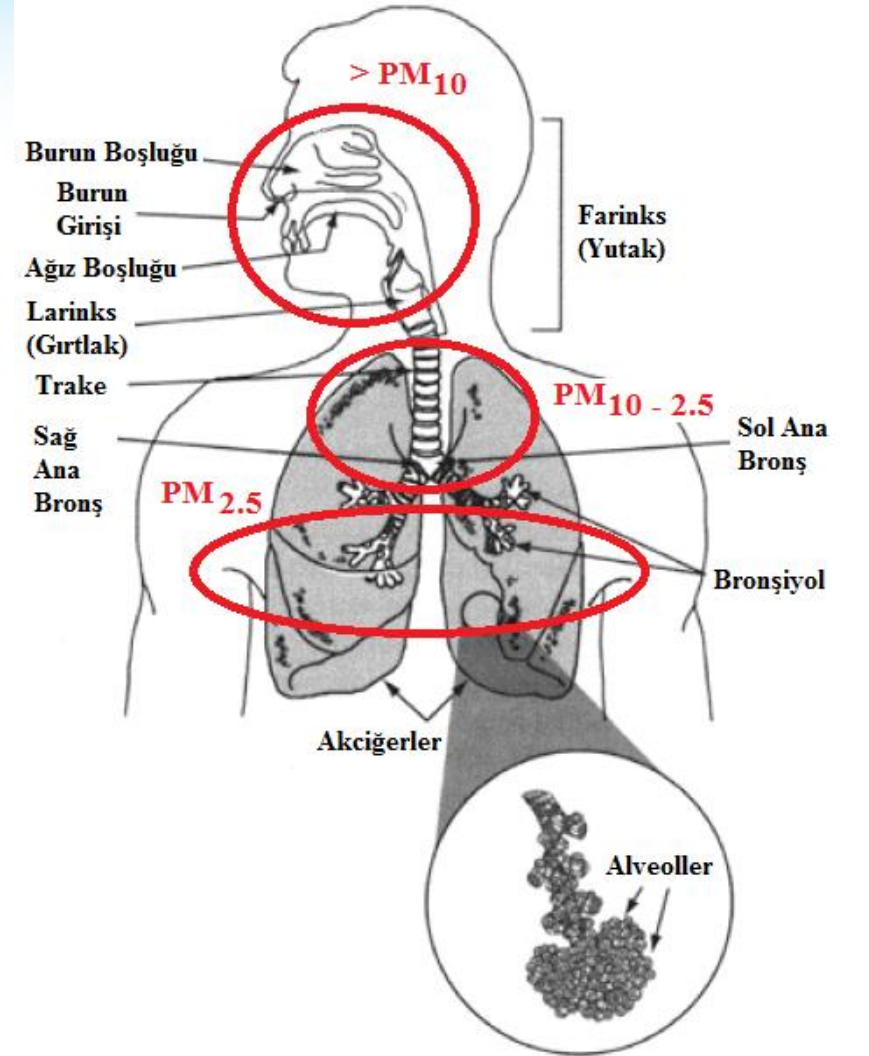
PM Kirliliğinin Etkileri

Sağlık Etkileri

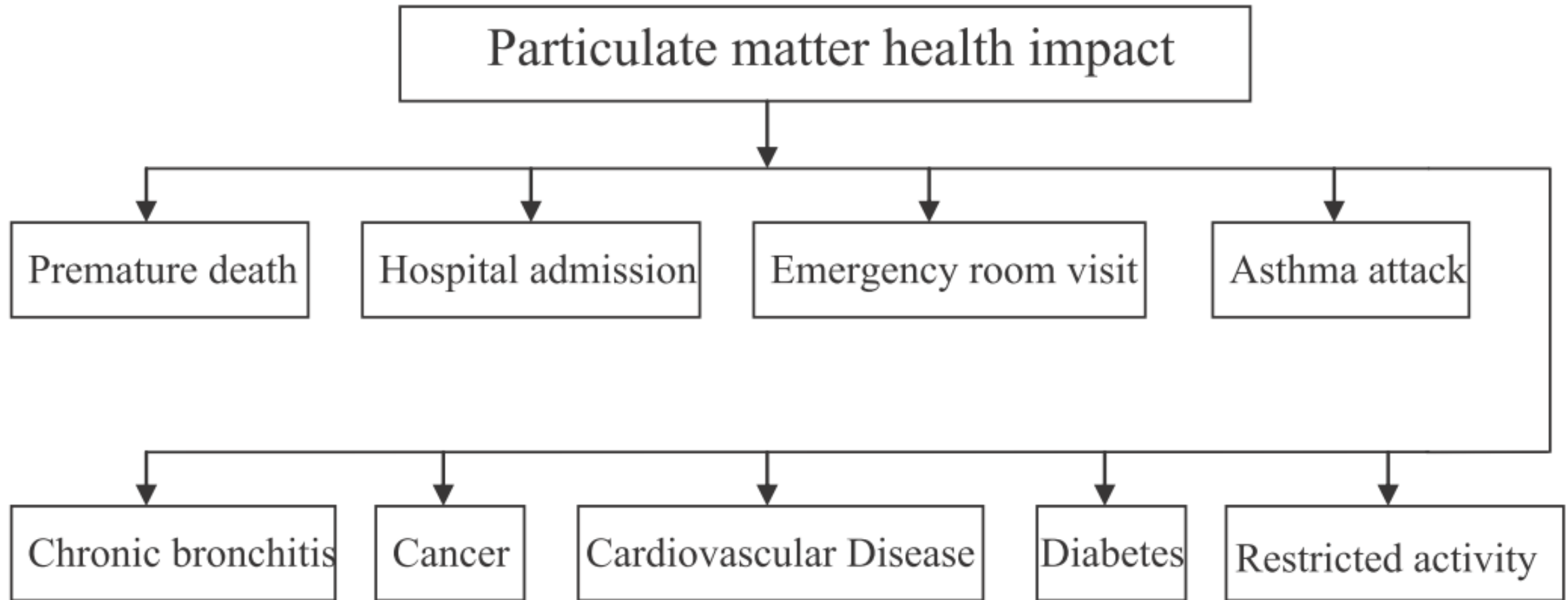
- Solunum sistemi
- Dolaşım sistemi
- Beyin ve sinir sistemi
- Düşük kiloda doğum
- Obezite
- Metabolik sendrom

- Hayvanlardaki etkileri insanlara benzer...
- Bitkilere etkiler
- Ekosisteme etkileri
- Radyasyon akısı – İklim değişikliği
- Yapılara etkileri
- Görüş seviyesine etkileri
- Enerji sistemlerine etkileri

PM boyutuna göre etki bölgeleri



Health impacts of PM exposure



PM_{2.5} Sağlık Etkileri

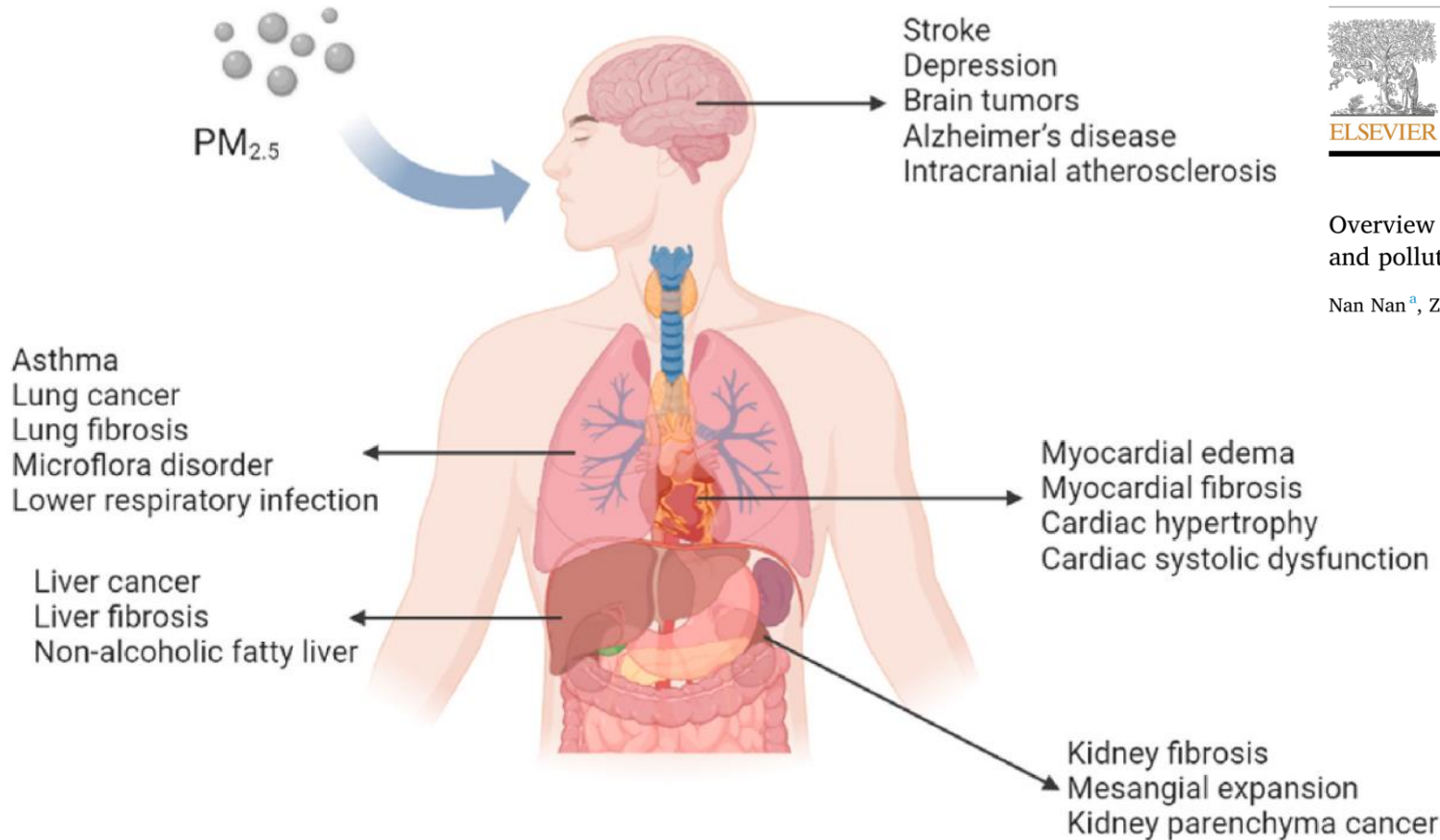


Fig. 1. Human health outcomes of PM_{2.5} exposure.

<https://www.sciencedirect.com/science/article/abs/pii/S0045653523004484>

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journal homepage: www.elsevier.com/locate/chemosphere



Overview of PM_{2.5} and health outcomes: Focusing on components, sources, and pollutant mixture co-exposure

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Environmental Toxicology and Pharmacology 4 (1997) 331–338

**ENVIRONMENTAL
TOXICOLOGY AND
PHARMACOLOGY**
ETAP

Ambient particulate matter and respiratory and cardiovascular illness in adults: particle-borne transition metals and the heart–lung axis^{1,2}

Robert S. Chapman ^{a,*}, William P. Watkinson ^b, Kevin L. Dreher ^b, Daniel L. Costa ^b

<https://www.sciencedirect.com/science/article/abs/pii/S138266899710031X>

Environment International 94 (2016) 591–599



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Particulate matter and early childhood body weight



Eunjeong Kim ^a, Hyesook Park ^b, Eun Ae Park ^c, Yun-Chul Hong ^d, Mina Ha ^e, Hwan-Cheol Kim ^f, Eun-Hee Ha ^{g,*}

<https://www.sciencedirect.com/science/article/abs/pii/S0160412016302392>

The FASEB Journal article fj.201500142. Published online February 18, 2016.

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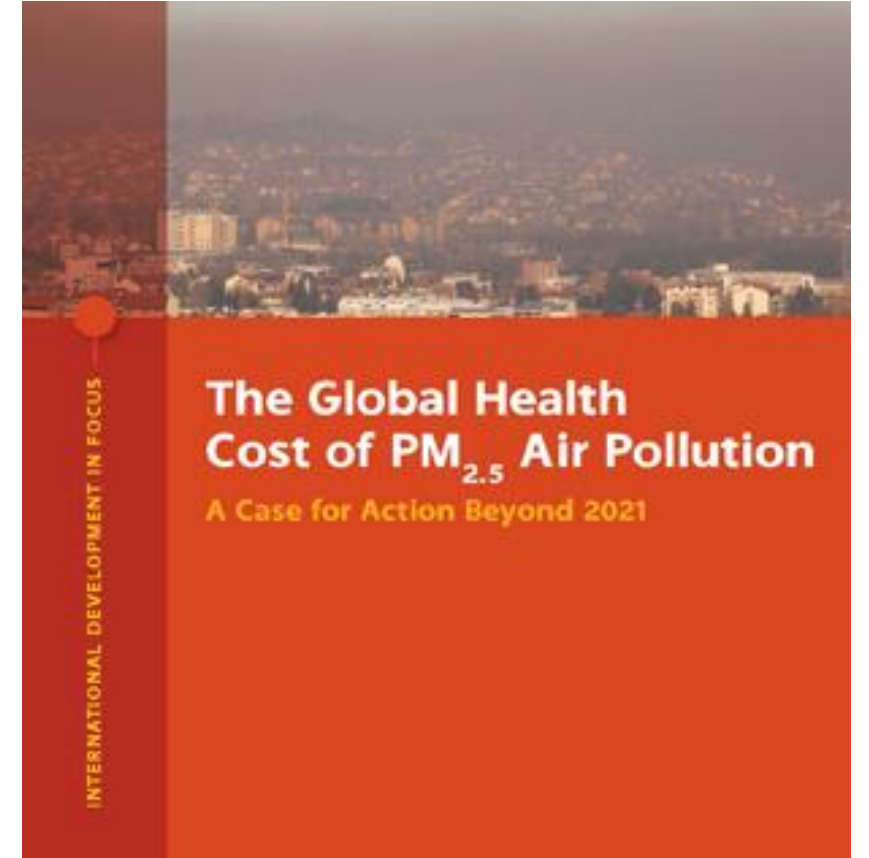
Chronic exposure to air pollution particles increases the risk of obesity and metabolic syndrome: findings from a natural experiment in Beijing

Yongjie Wei,^{*,†} Junfeng (Jim) Zhang,^{‡,§,1} Zhigang Li,[†] Andrew Gow,[¶] Kian Fan Chung,^{||} Min Hu,^{*} Zhongsheng Sun,[#] Limin Zeng,^{*} Tong Zhu,^{*} Guang Jia,^{**} Xiaoqian Li,[†] Marlyn Duarte,[‡] and Xiaoyan Tang^{*,1}

<https://faseb.onlinelibrary.wiley.com/doi/abs/10.1096/fj.201500142>

Hava Kirliliğinin Maliyeti

- Dünya Bankası, hava kirliliğinin neden olduğu sağlık hasarlarının küresel ekonomik etkisinin her yıl 8,1 trilyon dolar olduğunu tahmin ediyor.
- Bu miktar, küresel GSYİH'nin %6,1'ine denk geliyor.
- <https://openknowledge.worldbank.org/entities/publication/c96ee144-4a4b-5164-ad79-74c051179eee>



Terrestrial TM geochemical cycles with aerosols

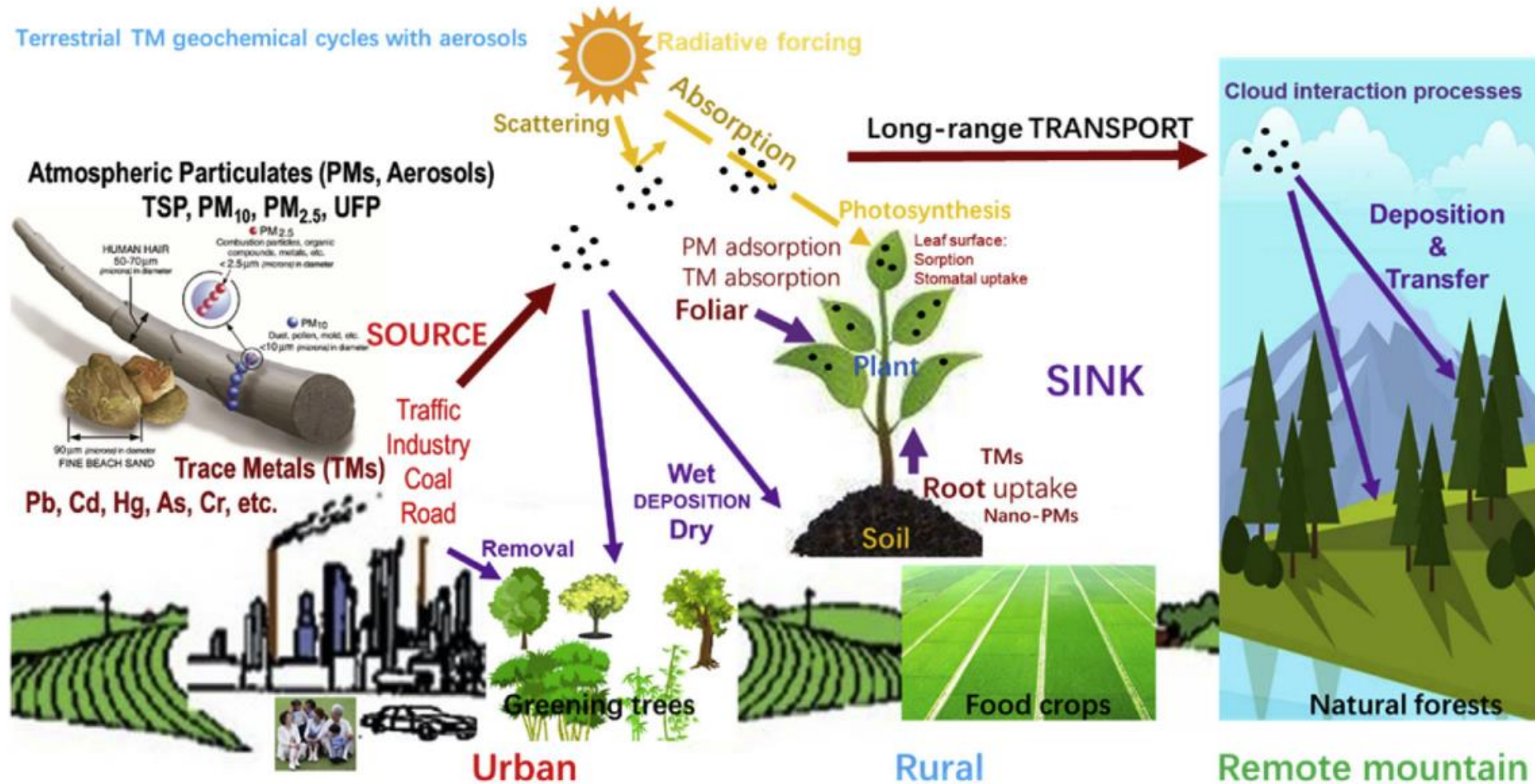


Fig. 1. Atmospheric PMs and associated TMs participating the terrestrial biogeochemical cycle of TMs in various soil-plant systems, including urban soil-tree, agricultural soil-crops, and remote mountain soil-forest systems.

<https://www.sciencedirect.com/science/article/abs/pii/S0269749119319864>

Asit Yağmurunun Sanat Yapılarına Etkileri



Asit Yağmurunun Ekosisteme Etkileri



PM Görüş Seviyesine Etkileri

Zonguldak, Türkiye



($PM_{10} = 190 \mu\text{g}/\text{m}^3$)
17 Mart 2014 - 17:44



($PM_{10} = 69 \mu\text{g}/\text{m}^3$)
18 Mart 2014 - 08:40

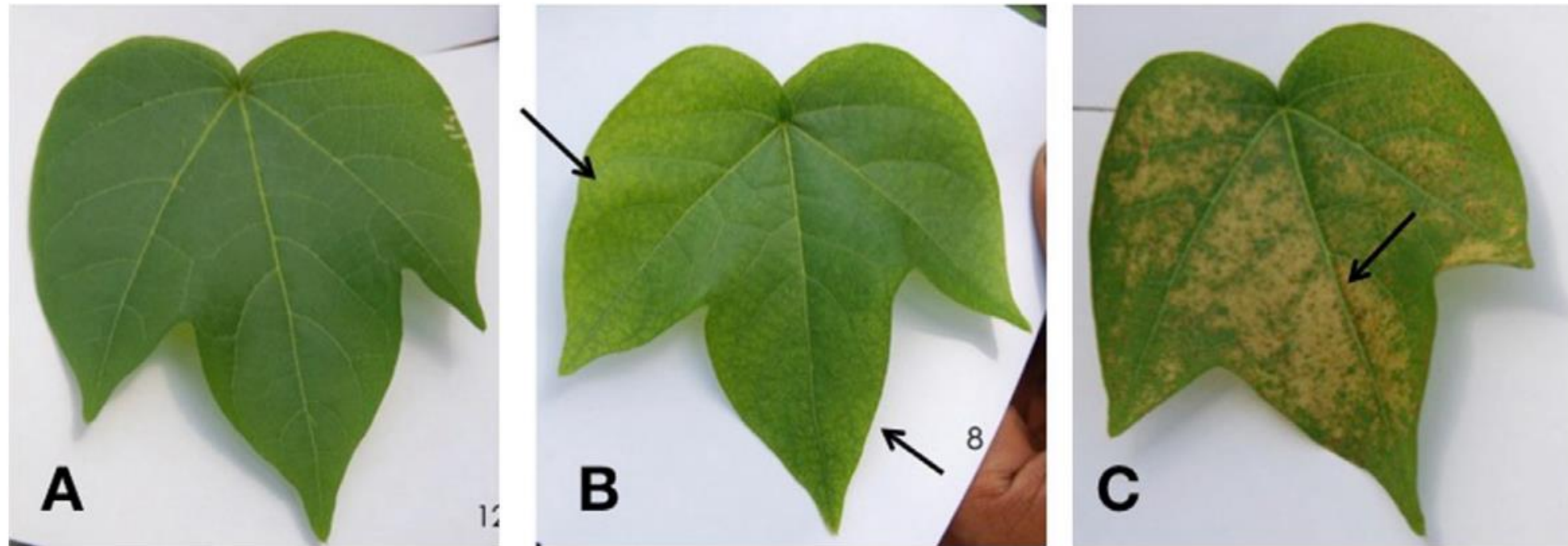


Fig. 1. Examples of no to extreme O_3 exposure effects in primary cotton leaves. (A) No exposure; (B) 15-min exposure to $1200 \text{ nl } O_3 \cdot \text{l}^{-1}$; (C) 15-min exposure to $2400 \text{ nl } O_3 \cdot \text{l}^{-1}$. Arrows in (B) indicate leaf margin 'burn' while arrow in (C) indicates lack of necrosis near the vein. Note the irregularity of the chlorosis in (B) and necrosis in (C) (photograph by D.A. Grantz).

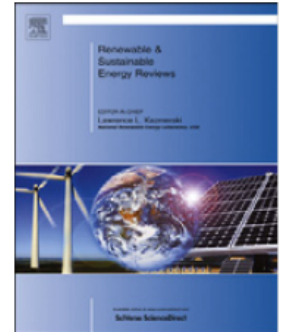
Renewable and Sustainable Energy Reviews 22 (2013) 698–733



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Renewable and Sustainable Energy Reviews

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A comprehensive review of the impact of dust on the use of solar energy:
History, investigations, results, literature, and mitigation approaches

Travis Sarver^a, Ali Al-Qaraghuli^b, Lawrence L. Kazmerski^{b,*}

<https://www.sciencedirect.com/science/article/abs/pii/S136403211300021X>



7 Eylül
Dünya Temiz
Hava Günü

CHRIS MADDEN