

Polusi udara dan Kesehatan janin & anak



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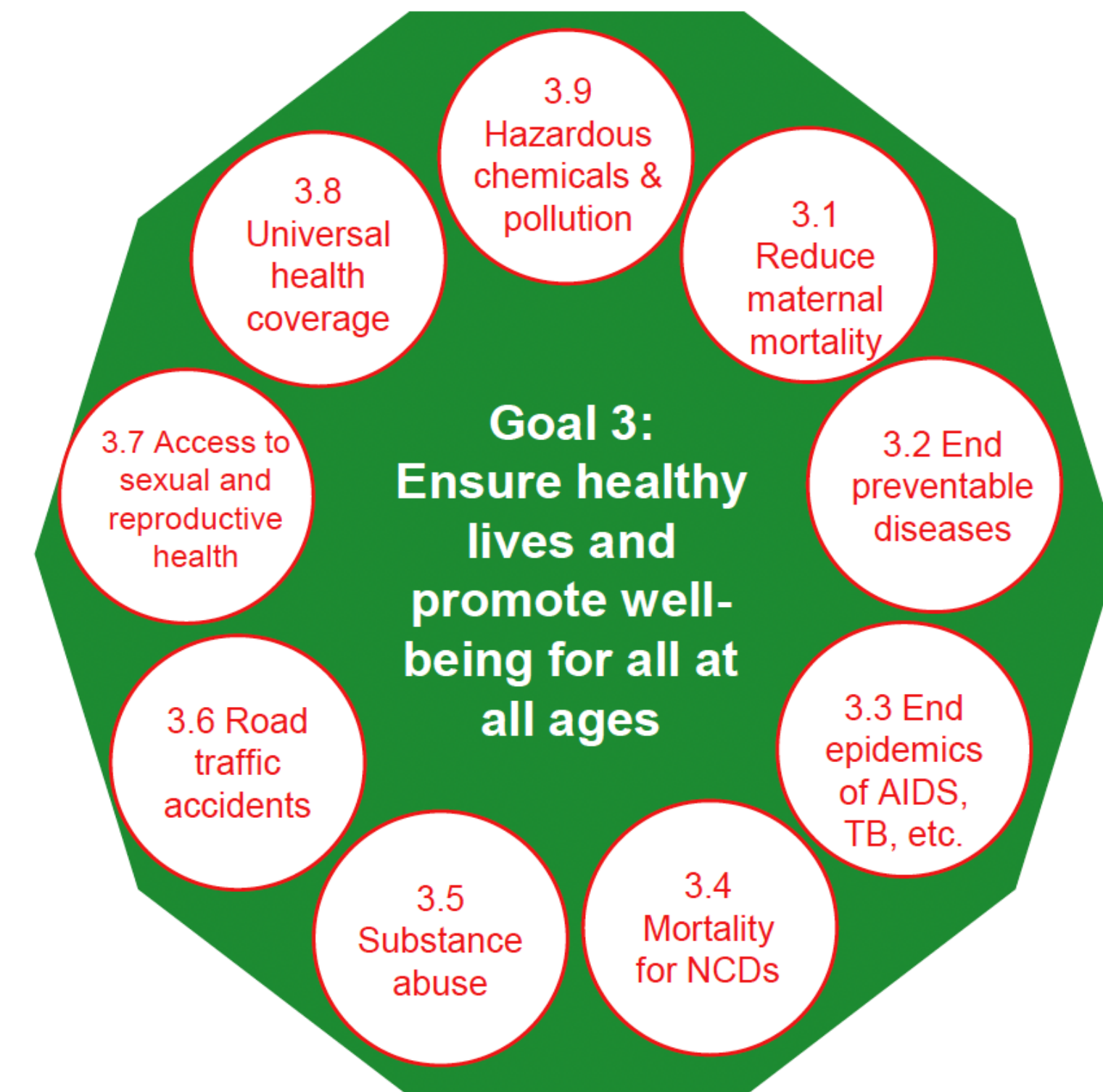


SDG's Goals dan kesehatan anak

The right to a healthy environment underpins the rights of all children not only to survive but to thrive and live in dignity.
“UN High Commissioner”
for Human



SDG goals



SDG targets

WHO-UNICEF

AIR POLLUTION IS A GLOBAL CHILDREN'S HEALTH ISSUE

Globally **93%** of all children and **630 million** children under 5 years are exposed to air pollution levels* above the WHO air quality guidelines

*fine particulate matter 2.5 micrometers or less in diameter (PM2.5)



THE BURDEN OF DISEASE FROM POLLUTED AIR IS HEAVIEST IN LOW- AND MIDDLE-INCOME COUNTRIES

Percentage of children under 5 years exposed to PM2.5* levels higher than the WHO air quality guideline are:



100%
Africa & Eastern Mediterranean



99%
South-East Asia



98%
Western Pacific



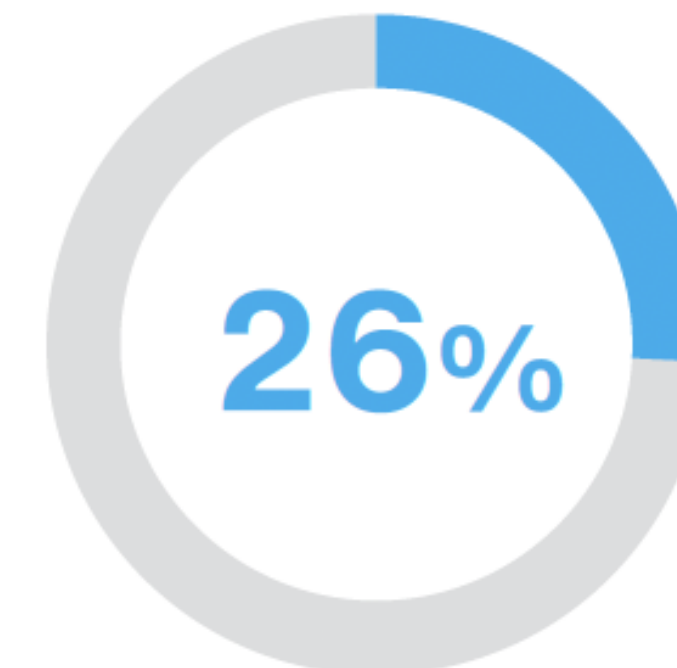
87%
Americas

98% Low- and middle-income countries

52% High-income countries

CLEAN AIR FOR CHILDREN'S HEALTH

[#AirPollution](#)



of deaths among children under 5 years can be prevented by addressing environmental risks.¹

Indonesia

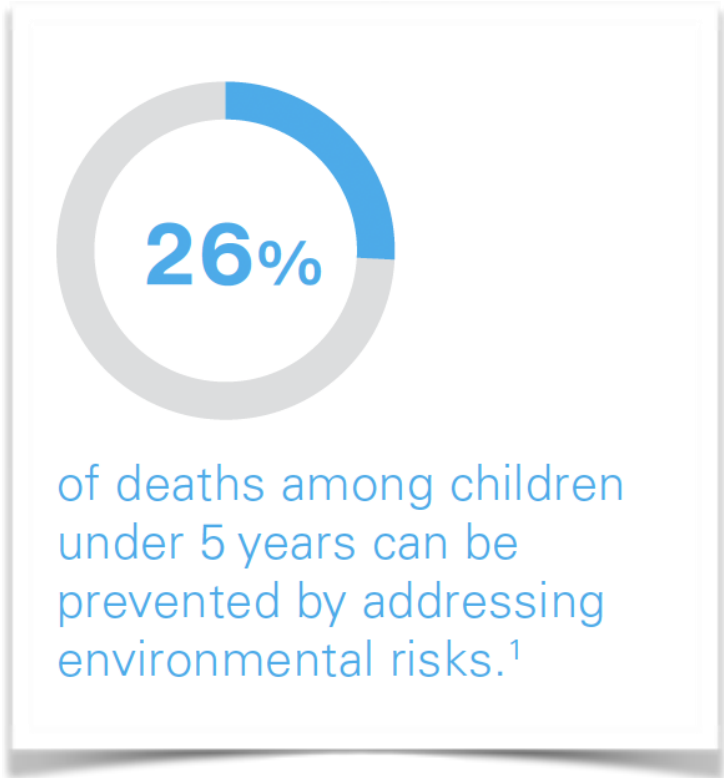
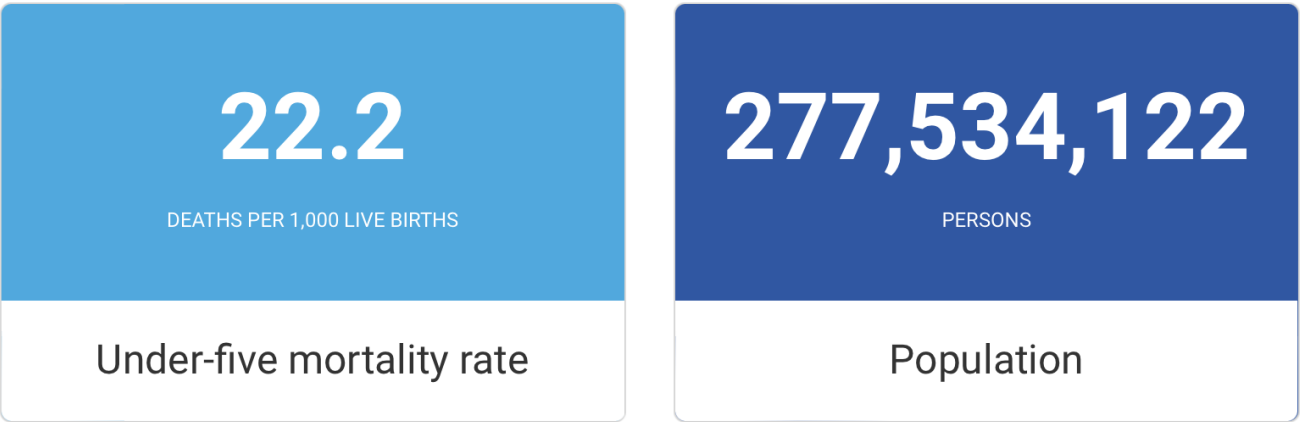
Country profiles >

Indonesia

Indonesia



Key demographic indicators



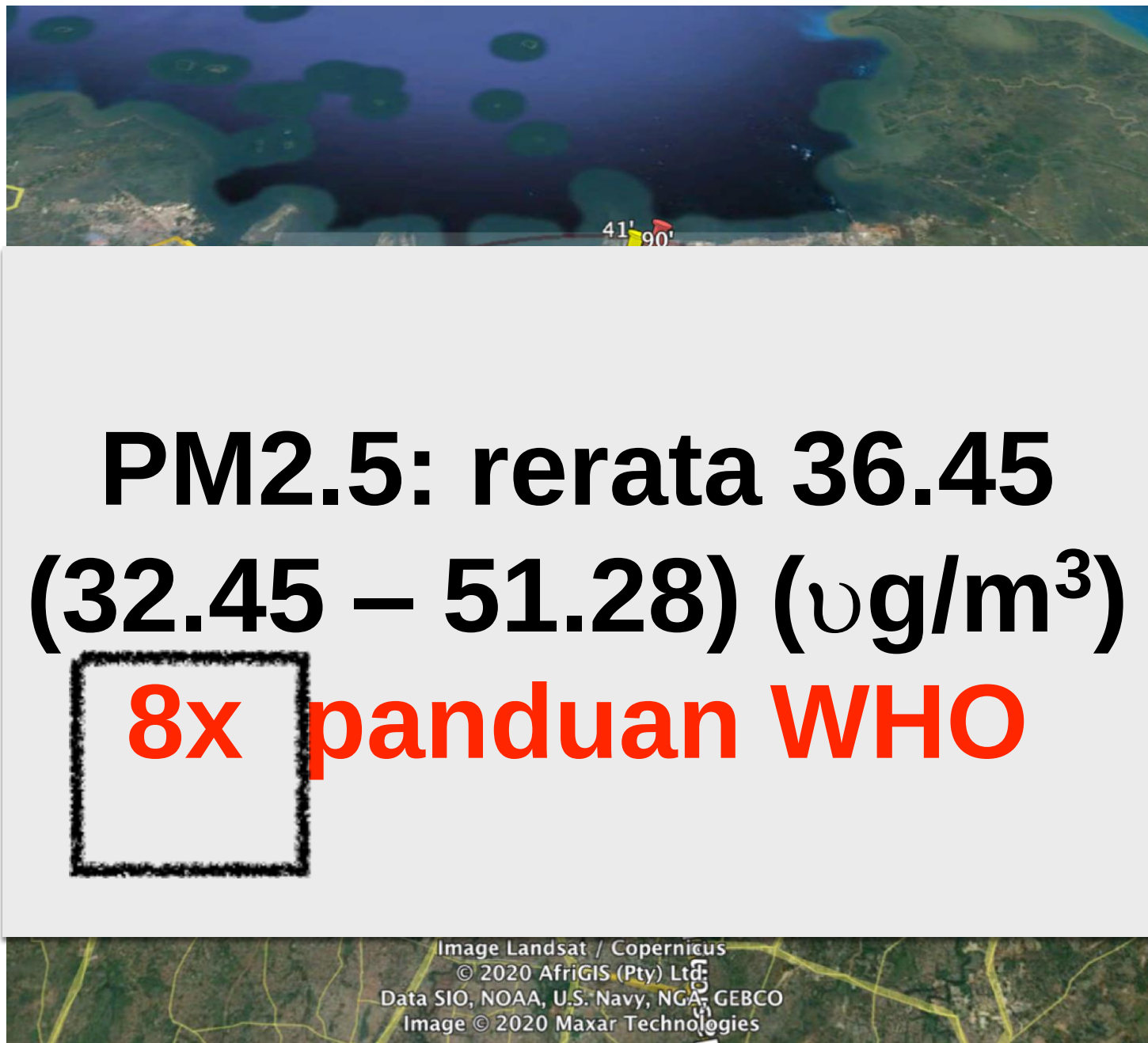
Jakarta (2022)
Jumlah anak 0-5 tahun: 2,4 juta

Jumlah kematian balita: 53.280

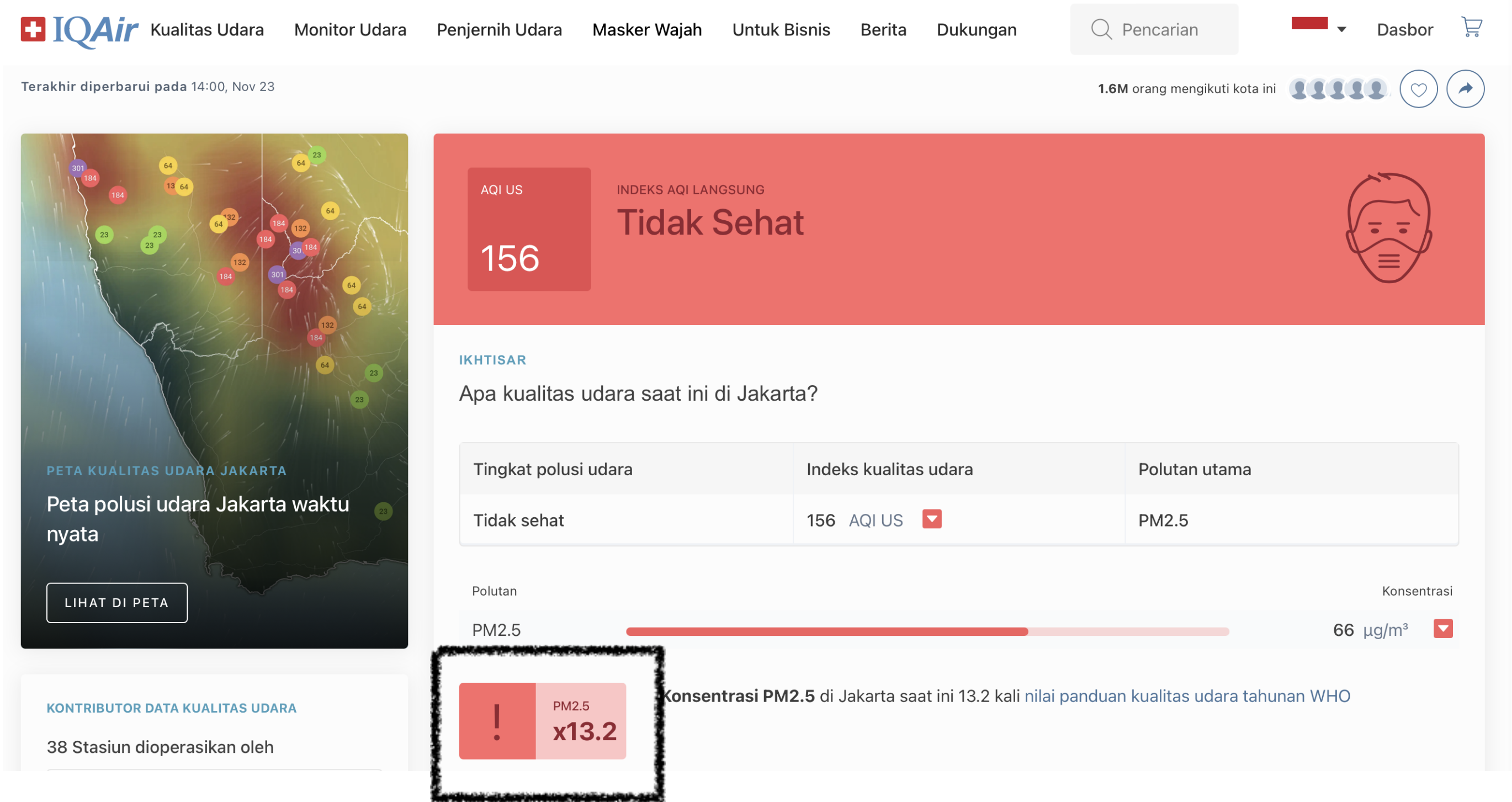
13.852 balita tahun



Jakarta



Tahun 2016-2018
(Penelitian kami)

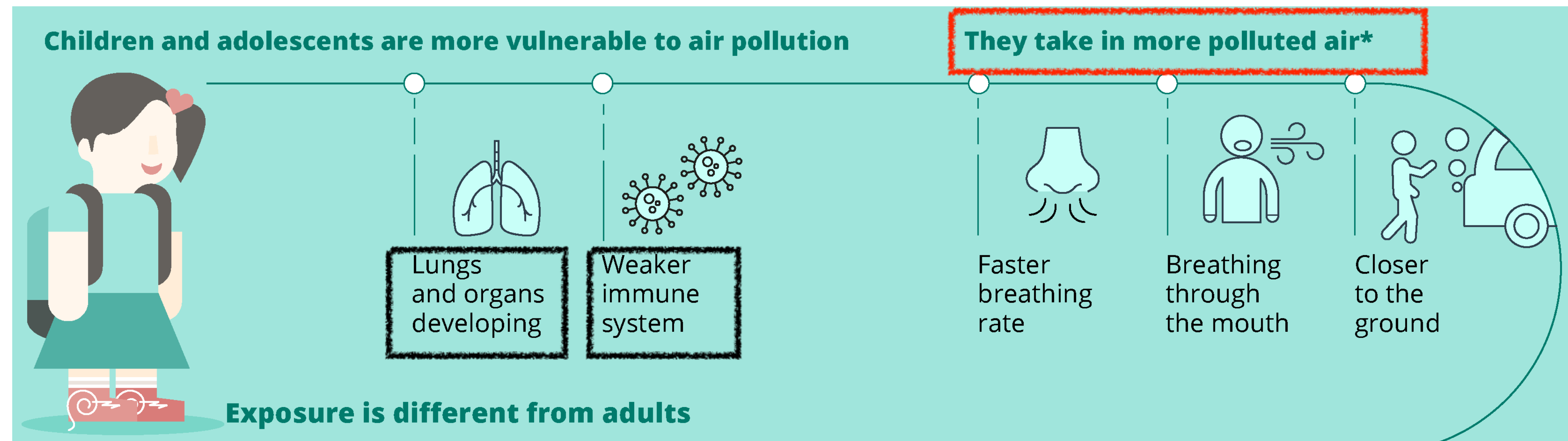


Tahun 2023
(Sekarang)

Waktu yg paling rentan (“windows of vulnerability”)

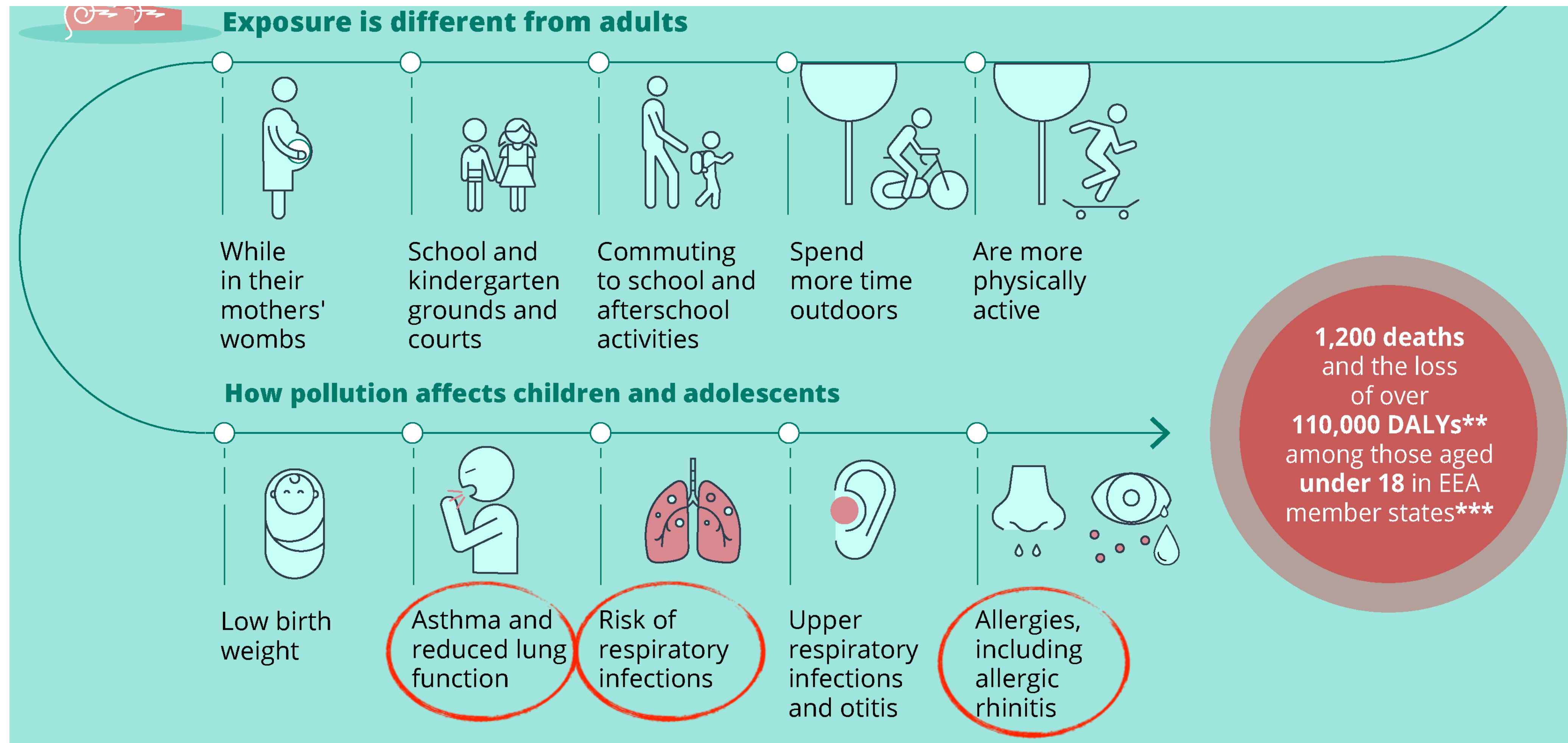


Anak dan remaja lebih rentan dari dewasa



<https://www.eea.europa.eu/publications/air-pollution-and-childrens-health#>

Kapan paparan terhadap polusi dan efeknya pada anak?



Efek negatif polusi udara terhadap janin



**Berat badan lahir rendah
(BBLR)**

Lahir prematur

Panjang lahir pendek

Pneumonia pada anak

Infeksi telinga

**Penurunan fungsi paru
pada anak**

**Peningkatan tekanan
darah pada bayi**

**Peningkatan tekanan
darah pada anak**

**Hipertensi pada anak
dan remaja**



Efek polusi udara terhadap bayi dan anak

Risiko Asma dan
penurunan fungsi paru

Gangguan
neurodevelopme
nt

↑ Risiko Autis

↑ Risiko Infeksi saluran nafas dan telinga

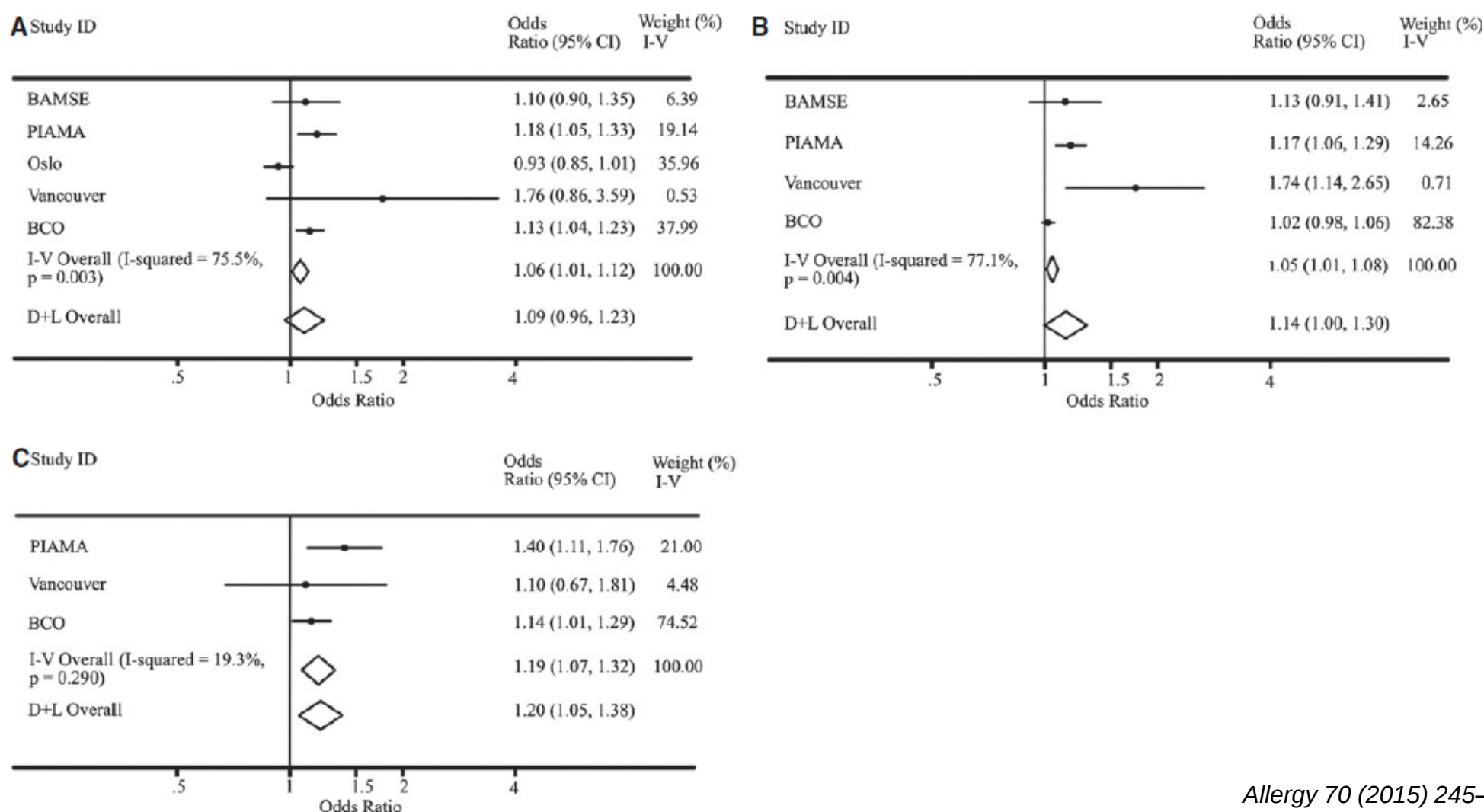
↑ Tekanan Darah dan
hipertensi

Gangguan
kardiovaskuler

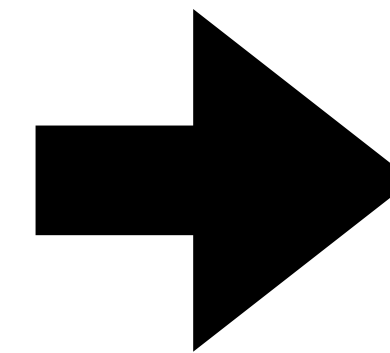
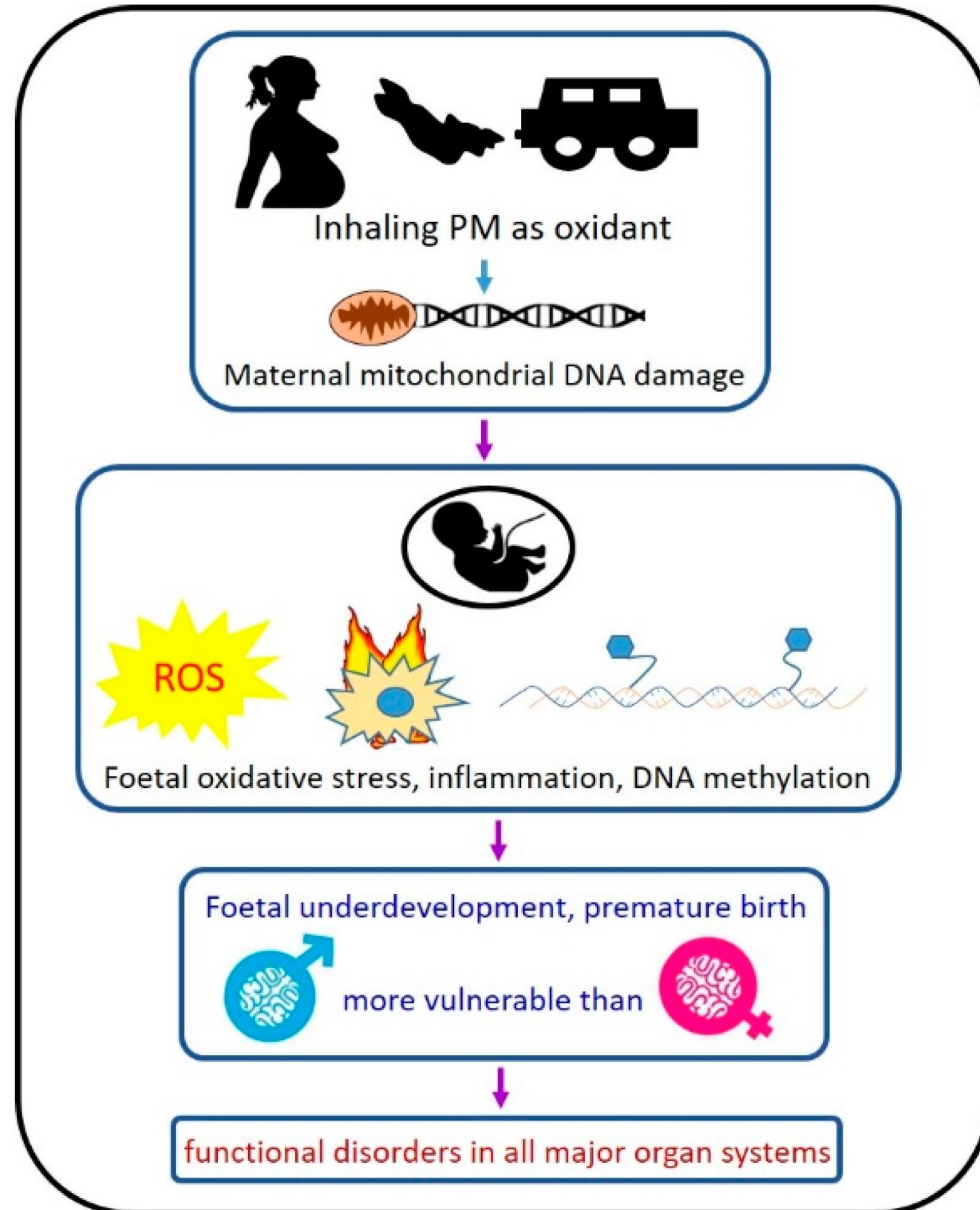
Obesitas

Pubertas lebih awal
atau lebih lambat

Gangguan
reproduksi



Efek polusi udara bersifat transgenerational



Antaranews.com

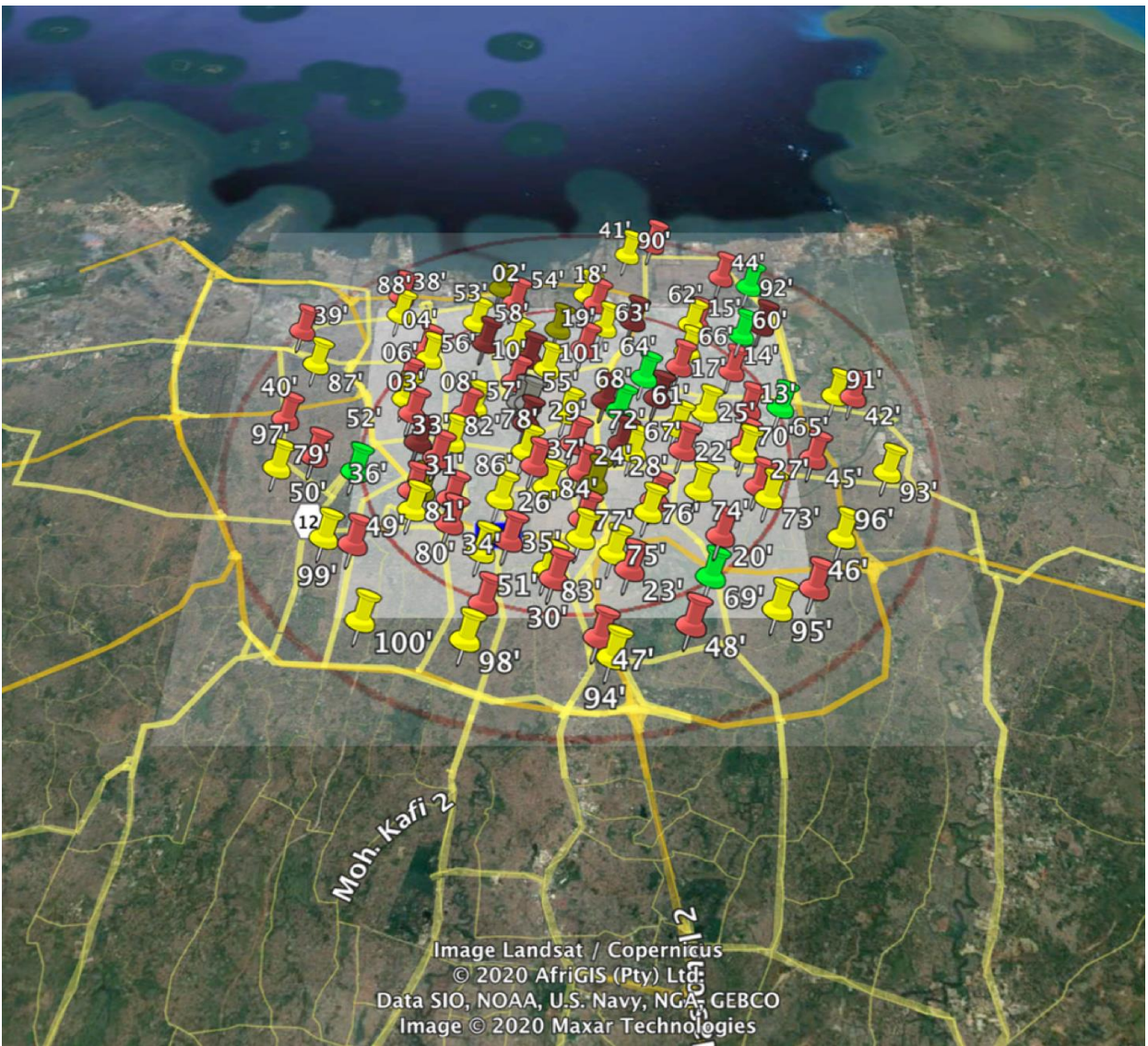
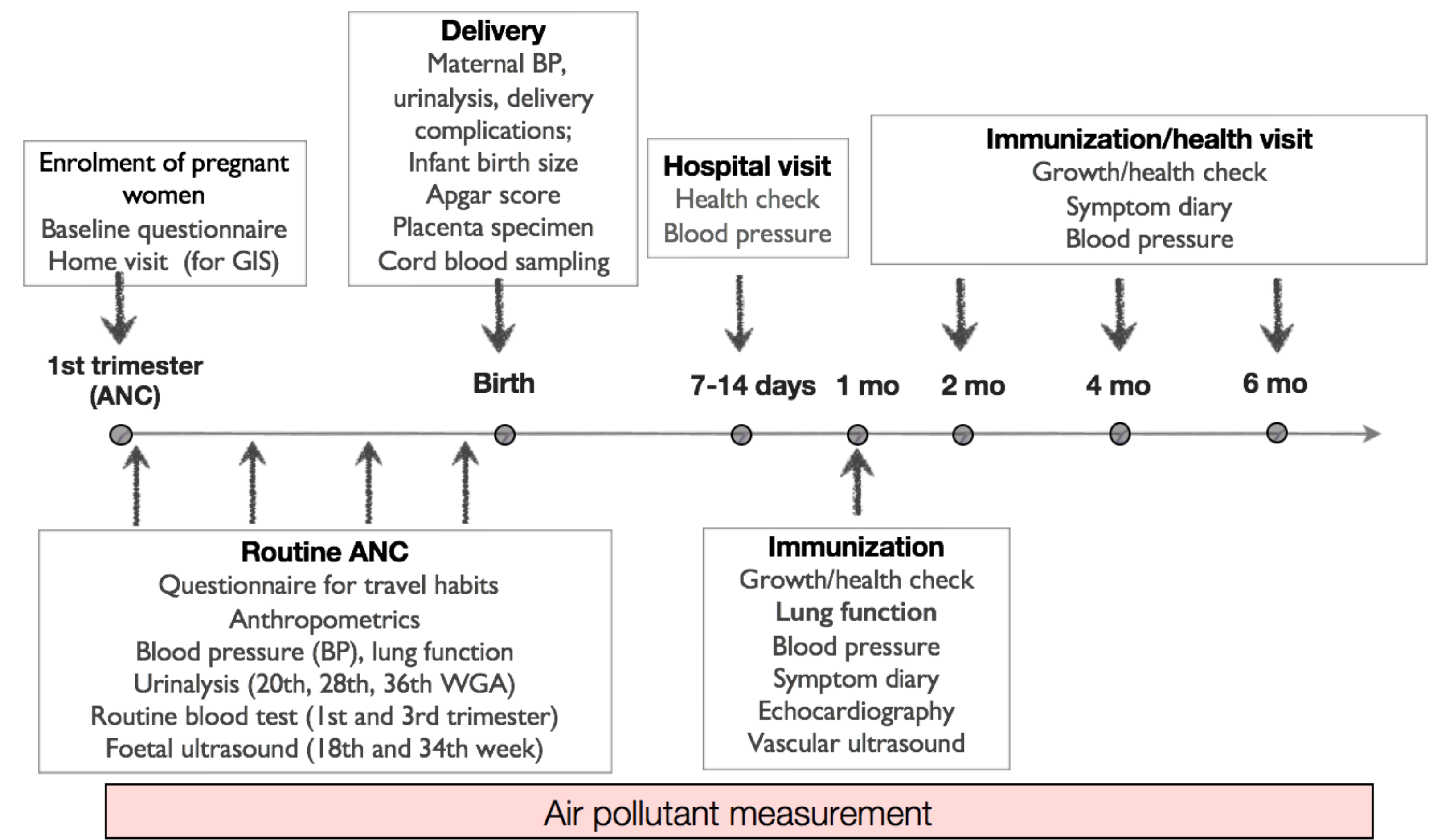




Hasil penelitian di Jakarta



Protokol Penelitian



Paparan polusi udara selama di kandungan & berat badan dan panjang badan bayi

Soesanti et al. *Environmental Health* (2023) 22:22
<https://doi.org/10.1186/s12940-023-00973-0>

Environmental Health

RESEARCH

Open Access



The effect of exposure to traffic related air pollutants in pregnancy on birth anthropometry: a cohort study in a heavily polluted low-middle income country

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3x panduan WHO

• PM_{2.5}, Black carbon, NO_x, NO₂



8x panduan WHO



Hasil

- Berat badan lahir lebih rendah
 - Panjang badan lahir lebih pendek
- 
- Risiko stunting dan pendek

	Linear regression coefficients (95% confidence interval)	
	Birth weight (g) (n = 340)	Birth length (mm) (n = 340)
PM _{2.5}		
Crude	−52.34 (−150.24; 45.57)	−3.43 (−7.93; 1.08))
Model 1	−36.84 (−126.91; 53.23)	−2.89 (−7.22; 1.44)
Model 2	−54.44 (−146.14; 37.27)	−3.45 (−7.87; 0.97)
Soot		
Crude	−47.02 (−116.78; 22.74)	−3.60 (−6;80; −0.40)*
Model 1	−46.75 (−110.77; 17.69)	−3.60 (−6;67; −0.54)*
Model 2	−48.76 (−113.15; 15.63)	−3.83 (−6;91; −0.75)*
NO _x		
Crude	−5.16 (−61.05; 50.74)	−2.18 (−4.74; 0.39)
Model 1	−6.86 (−58.18; 44.45)	−2.24 (−4.70; 0.21)
Model 2	−17.20 (−69.79; 35.39)	−2.82 (−5.33; −0.30)*
NO ₂		
Crude	−4.28 (−61.44; 52.87)	−1.35 (−4.33; 1.63)
Model 1	−6.45 (−58.92; 46.03)	−1.48 (−4.44; 1.47)
Model 2	−17.20 (−70.60; 36.02)	−1.91 (−4.98; 1.17)

All effect estimates correspond to interquartile increase of each air pollutant i.e. every 7.14 µg/m³ for PM_{2.5}, 0.75 × 10^{−5} per m for soot, 4.68 µg/m³ for NO_x, and 3.74 µg/m³ for NO₂

Berat badan lahir

- Meningkatkan risiko utk berat badan lahir rendah

Table 4 Association between exposure to outdoor air pollutants during pregnancy with low birth weight

Outdoor air pollutant (<i>n</i> = 340)	OR (95% confidence interval)
PM_{2.5}	
Crude	0.88 (0.35; 2.19)
Adjusted	1.04 (0.31; 3.46)
Soot	
Crude	1.34 (0.73; 2.48)
Adjusted	1.73 (0.78; 3.83)
NO_x	
Crude	1.12 (0.67; 1.86)
Adjusted	1.33 (0.68; 2.59)
NO₂	
Crude	1.09 (0.65; 1.84)
Adjusted	1.10 (0.58; 2.06)

All effect estimates correspond to interquartile increase of each air pollutant i.e. every 7.14 µg/m³ for PM_{2.5}, 0.75 × 10⁻⁵ per m for soot, 4.68 µg/m³ for NO_x, and 3.74 µg/m³ for NO₂

Paparan polusi udara selama di kandungan & meningkatnya risiko infeksi saluran nafas (atas dan bawah) pada bayi 0-6 bulan

- **PM2.5 dan black carbon meningkatkan risiko untuk ISPA dan Pneumonia/bronkiolitis**

Air pollutant concentration		Odd Ratio (95% Confidence interval)		
		Upper respiratory tract infection (n= 185)	Lower respiratory tract infection (n= 14)	Gastrointestinal infection (n=26)
PM _{2.5}	Crude	1.45 (0.92;2.28)	1.39 (0.54;3.56)	0.84 (0.38;1.87)
	Adjusted	1.50 (0.91;2.47)	1.45 (0.53;4.00)	0.97 (0.42;2.23)
Soot	Crude	1.17 (0.84;1.63)	1.34 (0.66;2.73)	0.99 (0.56;1.72)
	Adjusted	1.14 (0.79;1.64)	1.46 (0.69;3.10)	1.08 (0.57;2.02)
NO _x	Crude	0.83 (0.64;1.07)	1.40 (0.78;2.51)	1.15 (0.75;1.77)
	Adjusted	0.80 (0.60;1.06)	1.43 (0.75;2.72)	1.20 (0.73;1.98)
NO ₂	Crude	0.85 (0.65;1.10)	1.48 (0.78;2.76)	1.17 (0.74;1.84)
	Adjusted	0.81 (0.61;1.09)	1.52 (0.77;3.02)	1.25 (0.74;2.10)

Paparan polusi udara selama di kandungan & peningkatan tekanan darah pada bayi 0-6 bulan

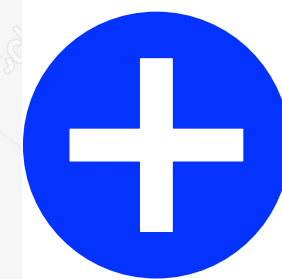
- PM2.5 dan Black carbon meningkatkan risiko peningkatan tekanan Darah

Reprogramming sistem kardiovaskuler

Hipertensi, stroke, penyakit Jantung pd usia lebih muda

Air pollutant	Model	β coefficient (95% Confidence interval)			
		1 month	2 months	4 months	6 months
PM _{2.5}	Crude	3.01 (0.66;5.35)*	1.05 (-1.34;3.43)	0.86 (-1.49;3.22)	1.98 (-0.24;4.19)
	Model 1	2.89 (0.53;5.25)*	0.90 (-1.54;3.33)	0.91 (-1.49;3.30)	1.88 (-0.37;4.13)
	Model 2	2.31 (-0.09;4.71) [#]	0.54 (-1.93;3.02)	1.07 (-1.31;3.45)	1.63 (-0.64;3.90)
Soot	Crude	0.81 (-0.93;2.54)	0.75 (-0.98;2.48)	0.88 (-0.88;2.64)	1.30 (-0.35;2.95)
	Model 1	0.82 (-0.92;2.57)	0.83 (-0.93;2.59)	0.82 (-0.97;2.60)	1.35 (-0.32;3.02)
	Model 2	0.64 (-1.11;2.39)	0.47 (-1.33;2.27)	0.60 (-1.17;2.37)	1.05 (-0.64;2.74)
NO _x	Crude	-1.05 (-2.40;0.31)	1.04 (-0.36;2.44)	1.28 (-0.11;2.67)	0.20 (-1.10;1.50)
	Model 1	-1.29 (-2.68;0.10)	1.02 (-0.41;2.45)	1.18 (-0.23;2.59)	0.10 (-1.22;1.42)
	Model 2	-1.08 (-2.48;0.32)	1.00 (-0.46;2.45)	1.08 (-0.32;2.49)	0.18 (-1.15;1.51)
NO ₂	Crude	-0.93 (-2.32;0.46)	1.04 (-0.39;2.47)	1.40 (-0.02;2.82)	0.29 (-1.04;1.61)
	Model 1	-1.15 (-2.58;0.27)	1.28 (-0.44;2.48)	1.30 (-0.15;2.74)	0.21 (-1.14;1.56)
	Model 2	-0.98 (-2.40;0.45)	0.95 (-0.53;2.43)	1.17 (-0.27;2.60)	0.23 (-1.13;1.59)

Generasi penerus —> *golden generation*?



What should we do?



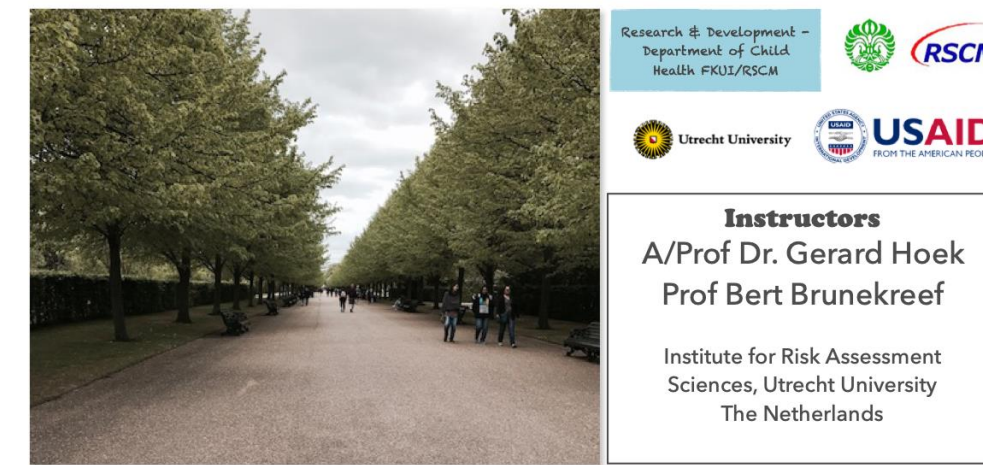
It's time to act. Let's protect our future generations

By giving them a healthy environment



Advanced course in Environmental Epidemiology

Jakarta, 2-6 Oct 2017



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Utrecht University

Instructors
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