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Supplemental Material

Estimates of the Global Burden of Ambient PM$_{2.5}$, Ozone, and NO$_2$ on Asthma Incidence and Emergency Room Visits

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Supplemental Tables

Table S1. Description of meta-analyses identified during literature review.

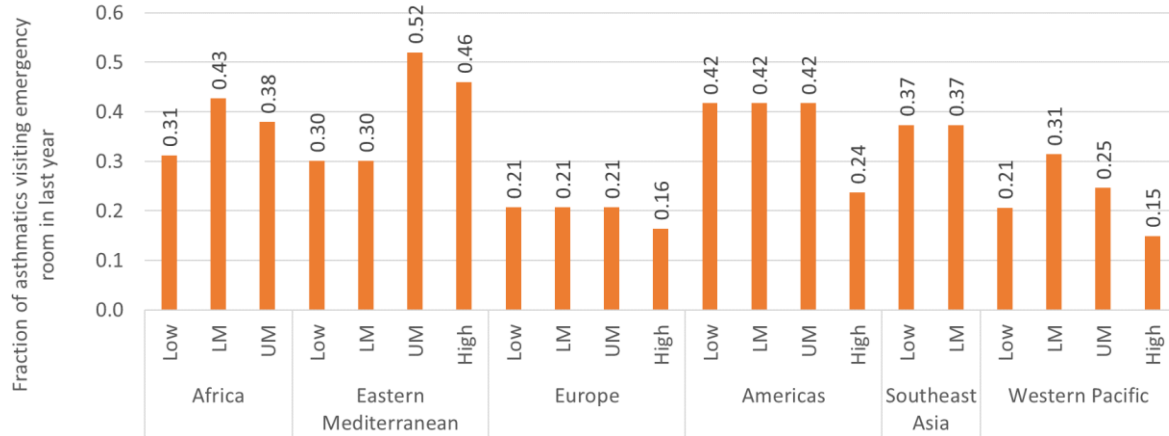| Study	Pollutants	Health endpoint	Population	Study locations
Orellano et al. (2017)	Ozone, $PM_{2.5}$, PM_{10}, NO_2, SO_2, CO	Asthma exacerbation	All ages	US, UK, Taiwan, China, Denmark, France, Canada, Australia, Italy, Spain, Turkey, Japan
Zheng et al. (2015)	Ozone, $PM_{2.5}$, PM_{10}, NO_2, SO_2, CO	Asthma exacerbation	All ages, children, adults	Ireland, Spain, France, UK, Canada, US, India, Mexico, Croatia, Japan, Australia, Switzerland, Greece, China, Italy, Cuba, Brazil, Korea, Denmark, Netherlands
Zhang et al. (2016)	Ozone, $PM_{2.5}$, PM_{10}, NO_2, SO_2, CO	Asthma exacerbation	All ages, children, adults	China, Taiwan, Japan, Korea
Fan et al. (2016)	$PM_{2.5}$	Asthma exacerbation	Children, adults	US, Canada, Finland, Taiwan
Lim et al. (2016)	$PM_{2.5}$	Asthma exacerbation	Children	US, Canada, China, Denmark, Finland, Australia, Turkey
Favarato et al. (2014)	NO_2 (traffic related)	Prevalence of asthma symptoms	Children	Spain, US, Netherlands, Sweden, South Korea, Germany, China, France, Czech Republic
Weinmayr et al. (2010)	NO_2, PM_{10}	Prevalence of asthma symptoms	Children	Mainly US, Europe, and "other" not defined
Anderson et al. (2013)	$PM_{2.5}$, NO_2	Asthma incidence	All ages, children	Sweden, Canada, Germany, US, UK, Norway, Netherlands
Bowatte et al. (2014)	$PM_{2.5}$, PM_{10}, black carbon, NO_2, NO, NOx (all traffic related)	Asthma incidence	Children	Norway, Sweden, Germany, Canada, Netherlands, US, Denmark, Spain
Jacquemin et al. (2015)	$PM_{2.5}$, PM_{10}, NO_2, traffic load, traffic intensity	Asthma incidence	All ages, adults	UK, Sweden, Netherlands, Germany
Khreis et al. (2017)	$PM_{2.5}$, PM_{10}, NO_2, NOx, black carbon (all traffic related)	Asthma incidence	Children	Netherlands, Canada, US, Germany, Sweden, England, Norway, Italy, Japan, Taiwan, China, Korea
Gasana et al. (2012)	$PM_{2.5}$, PM_{10}, NO_2, NOx, CO, SO_2 (all traffic related)	Asthma incidence	Children	France, Canada, Italy, China, US, Germany, Norway
Takenoue et al. (2012)	NO_2	Asthma incidence	Children	Brazil, Canada, US, Norway, France, China, Japan

Supplemental Figures

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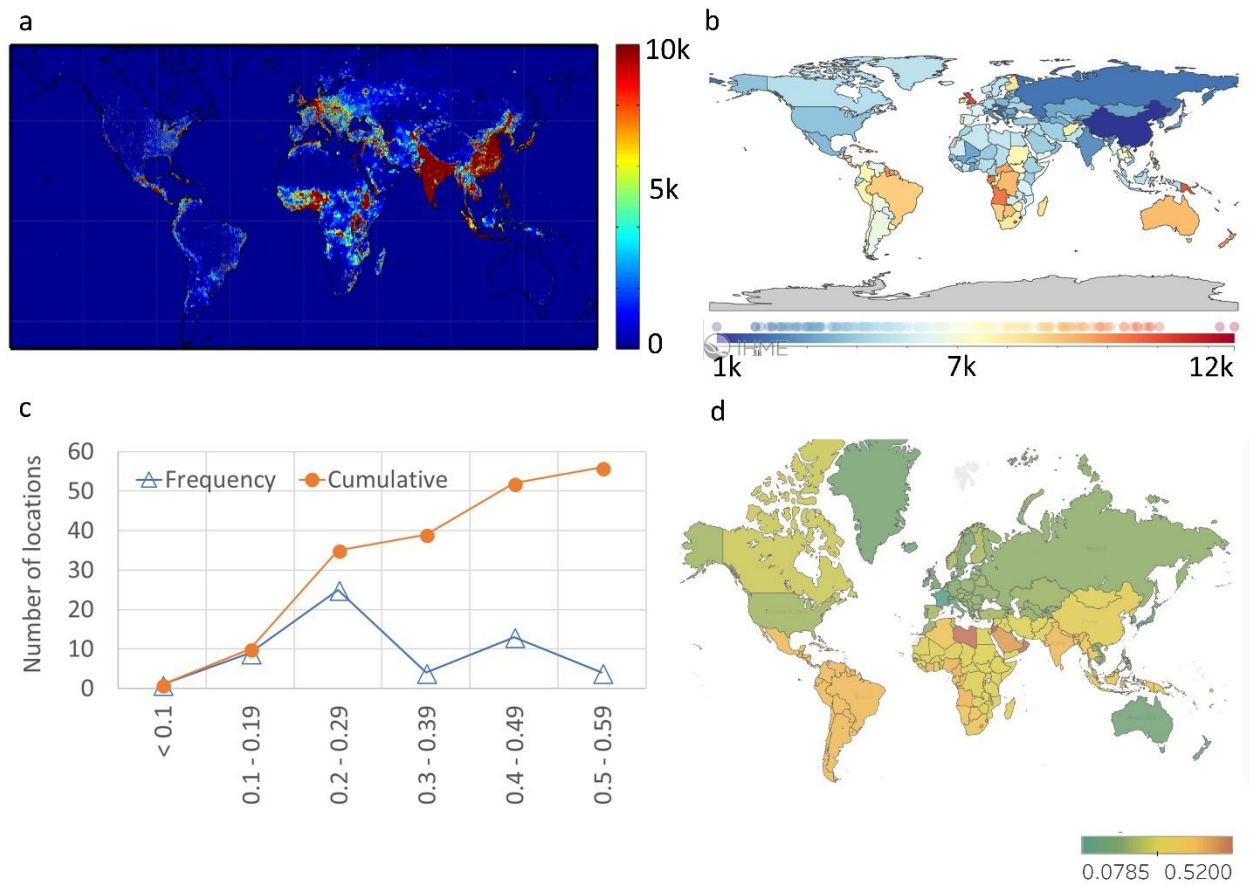
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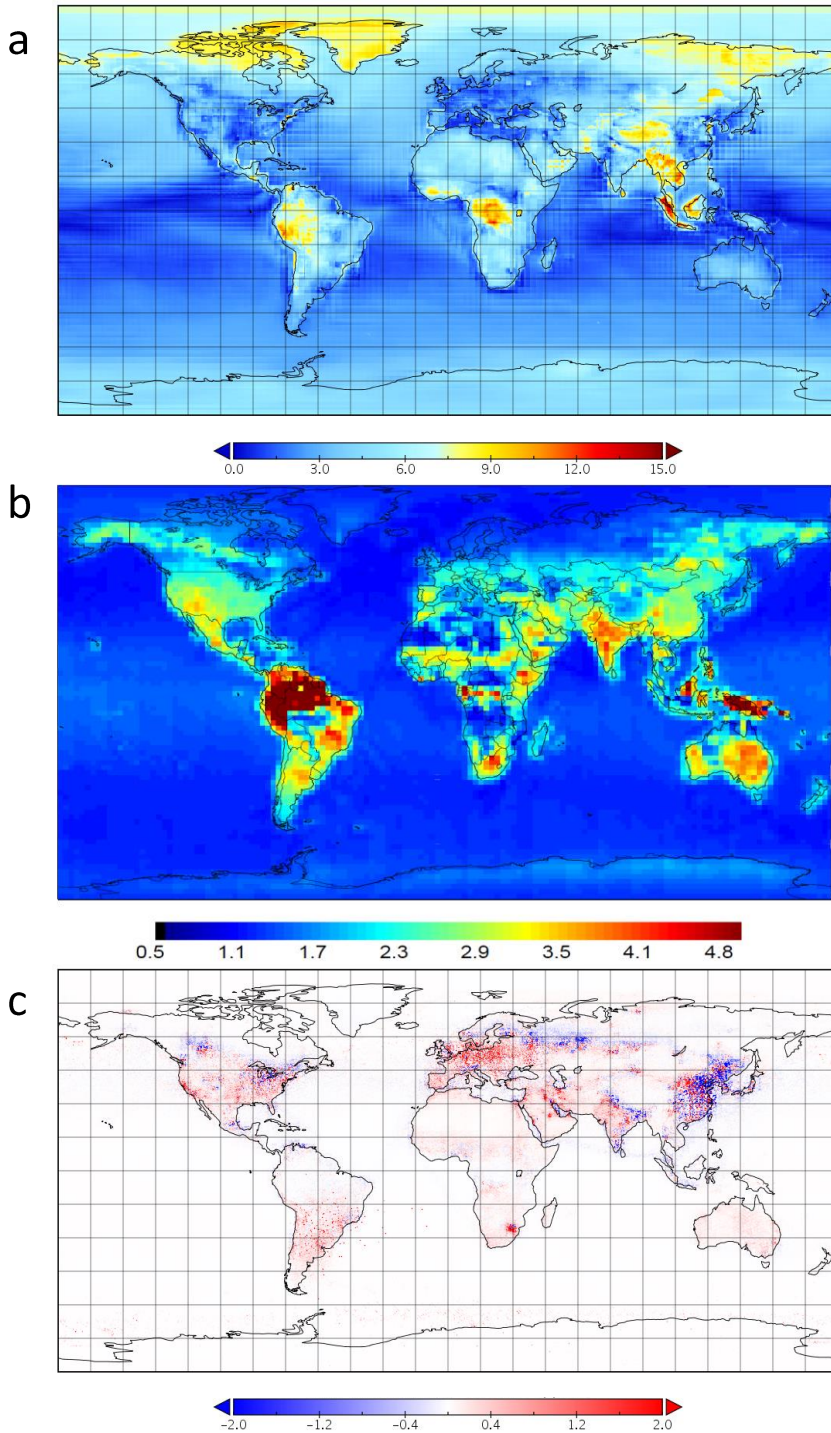
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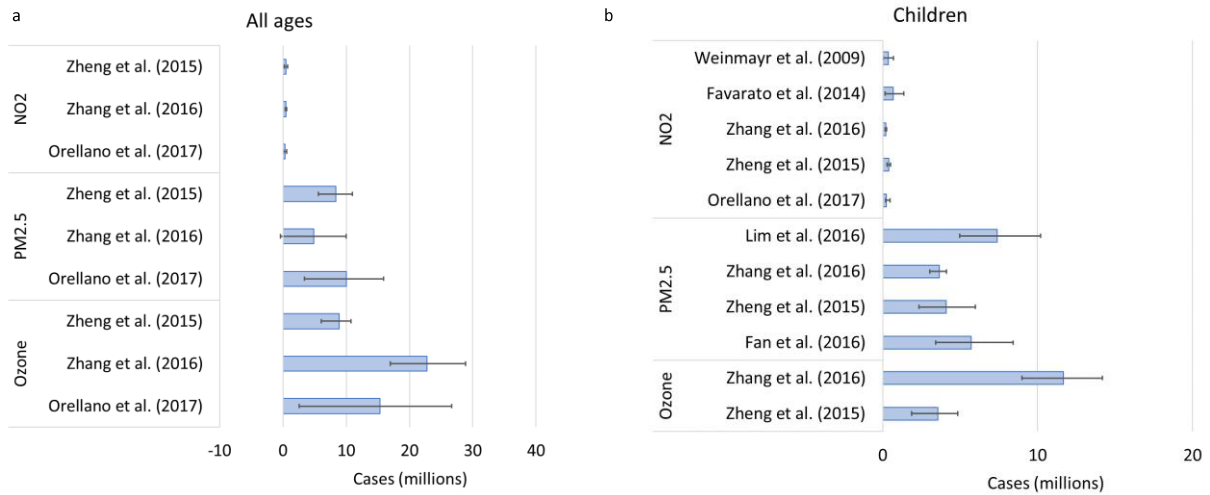
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	All ages (Emergency room visits / Incidence)	Children 0-17 (Emergency room visits / Incidence)
Africa	21.2M	12.9M
Americas	23.4M	12.1M
Eastern Mediterranean	12.1M	6.1M
Europe	9.1M	2.4M
Southeast Asia	34.0M	14.2M
Western Pacific	15.1M	5.3M
Africa	15.8M	11.7M
Americas	15.1M	9.3M
Eastern Mediterranean	9.6M	6.1M
Europe	6.6M	2.9M
Southeast Asia	21.3M	10.8M
Western Pacific	14.8M	6.4M

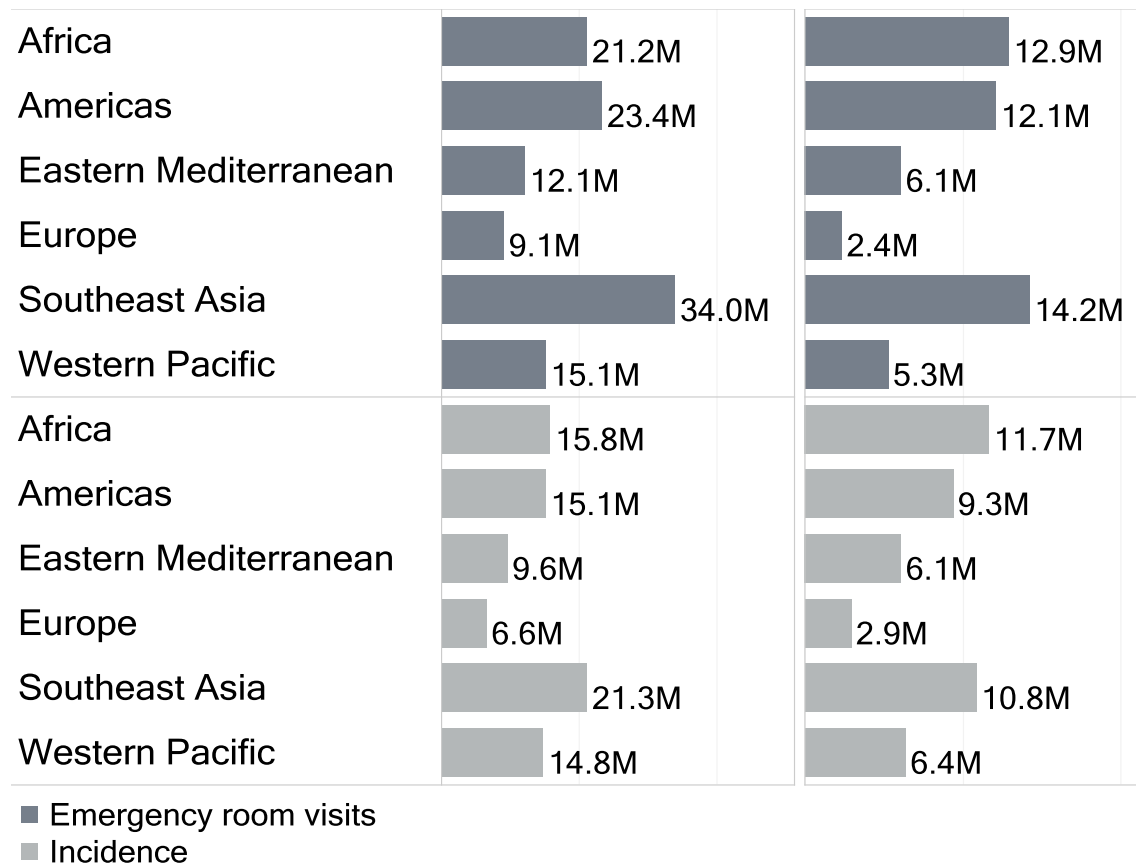■ Emergency room visits
■ Incidence

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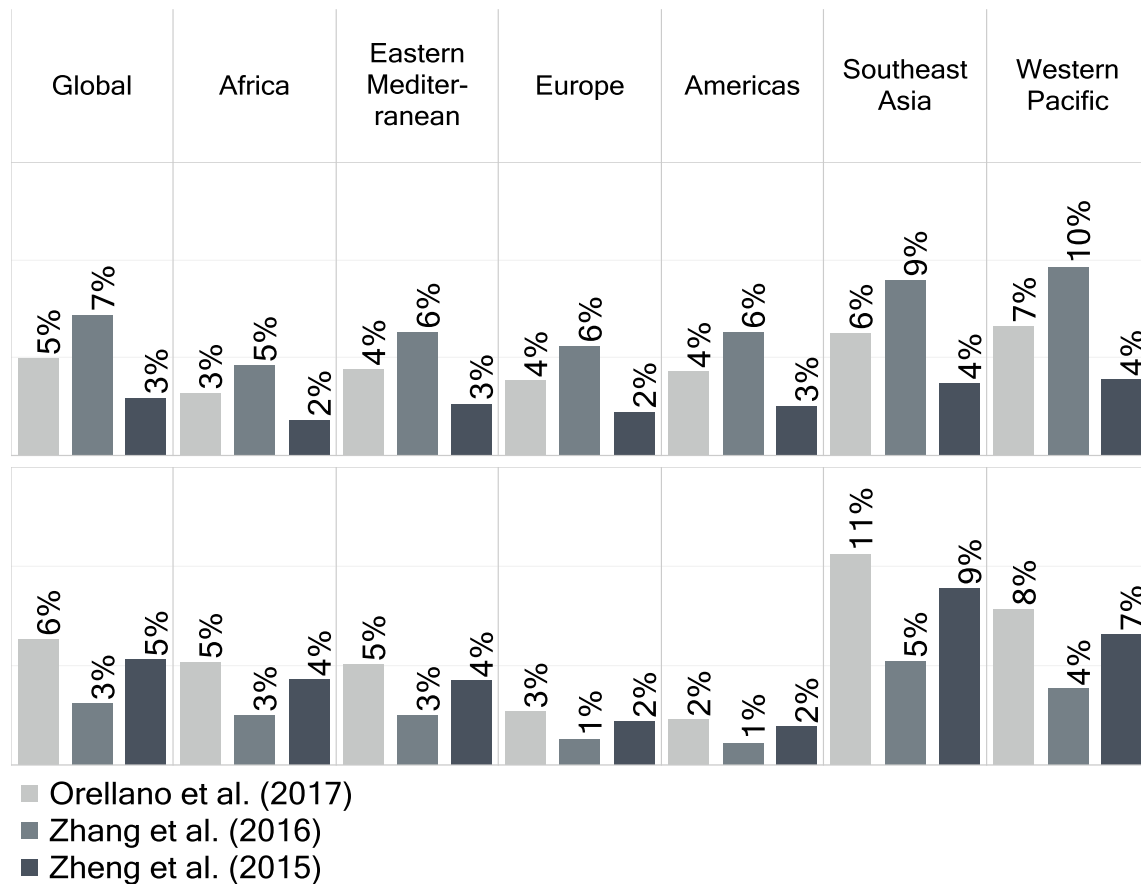
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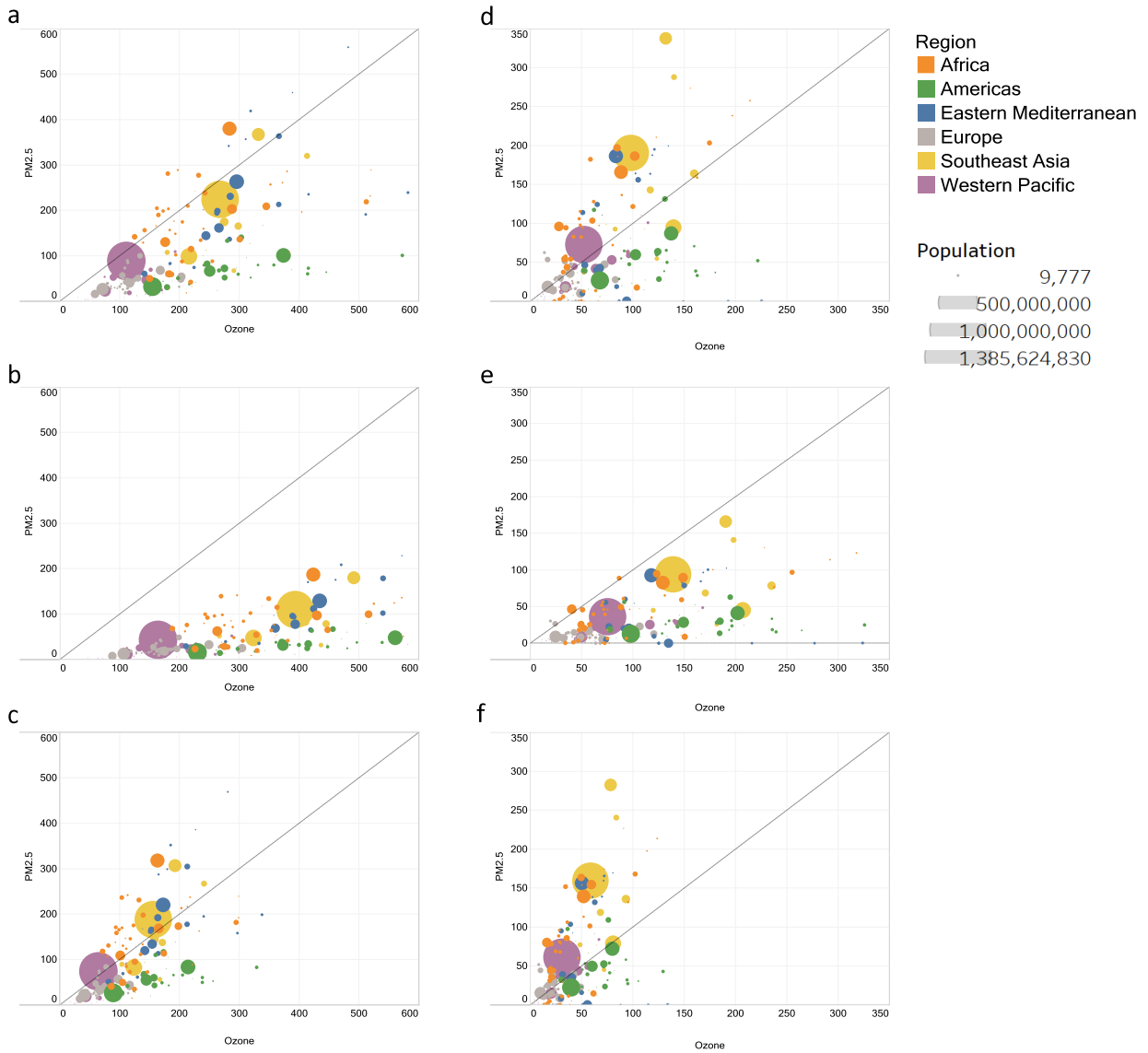
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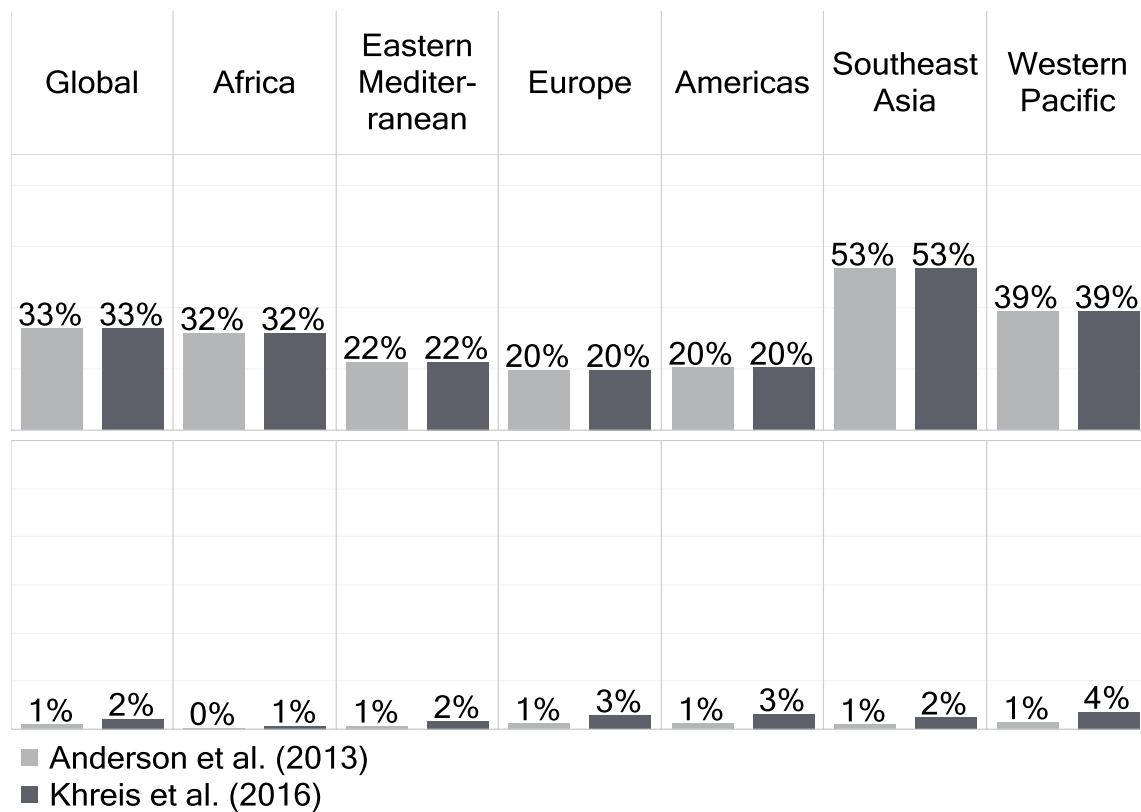
	Global	Africa	Eastern Mediter-ranean	Europe	Americas	Southeast Asia	Western Pacific
PM2.5 (Anderson)	33%	32%	22%	20%	20%	53%	39%
PM2.5 (Khreis)	33%	32%	22%	20%	20%	53%	39%
NO2 (Anderson)	1%	0%	1%	1%	1%	1%	1%
NO2 (Khreis)	2%	1%	2%	3%	3%	2%	4%

■ Anderson et al. (2013)
■ Khreis et al. (2016)

Figure S8. Percent of global and regional asthma incidence among children in 2015 that are attributable to anthropogenic $PM_{2.5}$ (top) and NO_2 (bottom), using RR central estimates from three epidemiological meta-analyses. Regions are defined by World Health Organization regions.
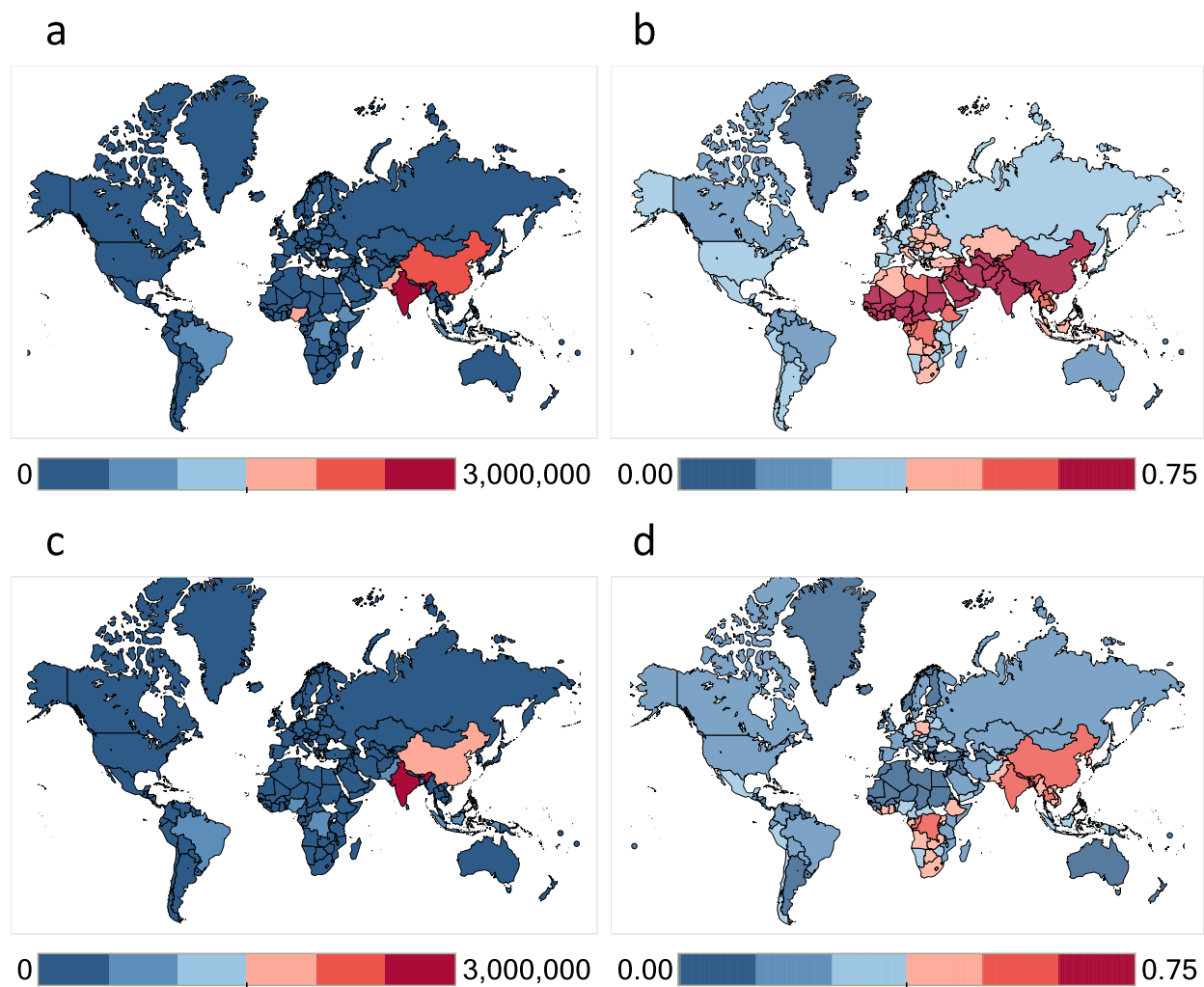
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