HelmholtzZentrum münchen German Research Center for Environmental Health

Health Effects of Ultrafine Particles

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Harmful Environment



Systemic Health Effects of Particulate Air Pollution



Thurston et al ERJ 2017

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HELMHOLTZ RESEARCH FOR GRAND CHALLENGES

Ultrafine and Fine Particles



De Jesus et al Env Int 2019



Ultrafine and Fine Particles – London 2015



De Jesus et al Env Int 2019



Where the Evidence Started: Panel Study in Asthmatics



Peters et al. AJRCCM 1997



Heath Effects Institute Review



Systematic Literature Review

International Journal of Public Health (2019) 64:547–559 https://doi.org/10.1007/s00038-019-01202-7

REVIEW





Health effects of ultrafine particles: a systematic literature review update of epidemiological evidence

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Ultrafine Particles and Health – Epidemiological Evidence

	1997-2011	2011-2017	Sum
Long-term Exposure			
Mortality	0	1	1
Morbidity	0	4	4
Emergency/hospital call/admission	0	0	0
Subclinical	0	5	5
All	0	10	10
Short-term Exposure			
Mortality	11	7	18
Morbidity/ Emergency/hospital call/admission	15	5	20
(Respiratory) Symptoms	8	11	19
Subclinical	52	55	107
All	86	78	164
Total	86	88	174

Morawska et al White Paper 2019

Systemic and Brain Impacts





Underwood Science 2017 - modified



US EPA Integrated Science Assessment: Ultrafine Particles

	Short-term Exposure	Long-term Expsoure
Respiratory Effects	Sugestive of, but not sufficient to infer	inadequate
Cardiovascular Effects	Sugestive of, but not sufficient to infer	inadequate
Metabolic Effects	inadequate	inadequate
Nerveous System Effects	Sugestive of, but not sufficient to infer	Sugestive of, but not sufficient to infer
Reproductive & Developmental Effects	-	inadequate
Cancer	-	inadequate
Mortality	inadequate	inadequate

Ongoing Efforts for Meta-Analysis

	1997-2017	New	Sum
Short-term			
Mortality	18	3	21
Morbidity	20	0	20
Lung Function	20	6	26
Cardiac Function			
Heart Rate Variability	25	1	26
Blood Pressure	16	*	16
Blood Biomarkers	35	8	43
Total	134	18	152

*not yet processed

unpublished



First Preliminary Results of the Meta-Analysis

Study	All-cause Mortality	PP	95%-01	Weights
	-	1.045		weights
Hennig et al., 2018, Ruhr Area		1.015	[0.991, 1.041]	2.59
Lanzinger et al., 2016, Augsburg		1.037	[0.938, 1.146]	0.16
Lanzinger et al., 2016, Dresden		0.98	[0.873, 1.101]	0.12
Lanzinger et al., 2016, Prague		0.957	[0.851, 1.076]	0.11
Lanzinger et al., 2016, Ljubljana		1.017	[0.777, 1.33]	0.02
Lanzinger et al., 2016, Chernivtsy —		0.858	[0.684, 1.077]	0.03
Peters et al. , 2009, Erfurt		1.012	[0.985, 1.039]	2.22
Staffogia et al., 2017, Helsinki		1.008	[0.986, 1.03]	3.27
Staffogia et al., 2017, Stockholm		0.992	[0.971, 1.013]	3.52
Staffogia et al., 2017, Copenhagen		0.983	[0.95, 1.018]	1.3
Staffogia et al., 2017, Rome	-	1.004	[1, 1.009]	76.91
Staffogia et al., 2017, Barcelona	-	0.997	[0.981, 1.012]	6.43
Staffogia et al., 2017, Athens	+	1	[0.978, 1.022]	3.33
Pooled Est.		1.004	[1, 1.007]	100%
Prediction interval Heteroreneity: $l^2 = 0\%$, $r^2 = 0.000000$, $n = 0.801$			[1, 1.007]	
Γοτοτοχοτισιτά. τ = 0.00 τ = 0.0000 · 00, μ = 0.001 Γ 0.	7 1 1.3			
	Relative Risk per 10000			

unpublished

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Long-term Health Effects of Ultrafine Particles



Downward et al EHP 2018

Impact of Combustion Aerosols and Health





Summary

- Exposures to ultrafine and fine particles differ in space and time
- Experimental and epidemiological studies suggest independent short-term health effects
- Studies on long-term health effects are missing
- It is recommended to keep daily levels below 10 000 particles cm⁻³ to avoid health effects





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Metaanalyses Steering Group

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https://efca.net/files/WHITE%20PAPER-UFP%20evidence%20for%20policy%20makers%20(25%20OCT).pdf

