

# Effects of Air Pollution on the Risk of Congenital Anomalies: A Systematic Review and Meta-Analysis

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**Table S1.** Numbers of cases and controls of congenital heart defects in studies included in the meta analysis.

Articles	Defects	Exposure	Case	Control
Gianicolo <i>et al.</i> , 2014 [1]	VSD	SO <sub>2</sub>	40	150
Schembri <i>et al.</i> , 2013 [2]	VSD	NO <sub>2</sub>	351	2869
	VSD	PM <sub>10</sub>	106	903
	ASD	NO <sub>2</sub>	229	2869
	ASD	PM <sub>10</sub>	58	903
	COA	PM <sub>10</sub>	28	890
	COA	NO <sub>2</sub>	69	2869
	TF	PM <sub>10</sub>	17	890
	TF	NO <sub>2</sub>	49	2650
Agay-Shay <i>et al.</i> , 2013 [3]	VSD	SO <sub>2</sub>	493	130,402
	VSD	PM <sub>10</sub>	493	130,402
	VSD	NO <sub>2</sub>	493	130,402
	VSD	CO	493	130,402
	VSD	O <sub>3</sub>	493	130,402
	ASD	SO <sub>2</sub>	534	130,402
	ASD	PM <sub>10</sub>	534	130,402
	ASD	NO <sub>2</sub>	534	130,402
	ASD	CO	534	130,402
	ASD	O <sub>3</sub>	534	130,402
Dadvand <i>et al.</i> , 2011 [4]	VSD	SO <sub>2</sub>	1154	4616
	VSD	PM <sub>10</sub>	1154	4616
	VSD	NO <sub>2</sub>	1154	4616
	VSD	CO	1154	4616
	VSD	O <sub>3</sub>	1154	4616
	ASD	SO <sub>2</sub>	274	1096
	ASD	PM <sub>10</sub>	274	1096
	ASD	NO <sub>2</sub>	274	1096
	ASD	CO	274	1096
	ASD	O <sub>3</sub>	274	1096
	COA	SO <sub>2</sub>	125	500
	COA	PM <sub>10</sub>	125	500
	COA	NO <sub>2</sub>	125	500
	TF	SO <sub>2</sub>	126	504
	TF	PM <sub>10</sub>	126	504
	TF	NO <sub>2</sub>	126	504

**Table S1.** Cont.

<b>Articles</b>	<b>Defects</b>	<b>Exposure</b>	<b>Case</b>	<b>Control</b>
Dadvand <i>et al.</i> , 2011 [5]	COA	SO <sub>2</sub>	127	508
	TF	SO <sub>2</sub>	140	560
Dolk <i>et al.</i> , 2010 [6]	COA	SO <sub>2</sub>	176	759,817
	COA	PM <sub>10</sub>	176	759,817
	COA	NO <sub>2</sub>	176	759,817
	TF	SO <sub>2</sub>	146	759,817
	TF	PM <sub>10</sub>	146	759,817
	TF	NO <sub>2</sub>	146	759,817
Hansen <i>et al.</i> , 2009 [7]	VSD	SO <sub>2</sub>	222	1110
	VSD	PM <sub>10</sub>	222	1110
	VSD	NO <sub>2</sub>	222	1110
	VSD	CO	222	1110
	VSD	O <sub>3</sub>	222	1110
	ASD	SO <sub>2</sub>	127	635
	ASD	PM <sub>10</sub>	127	635
	ASD	NO <sub>2</sub>	127	635
	ASD	CO	127	635
	ASD	O <sub>3</sub>	127	635
Strickland <i>et al.</i> , 2009 [8]	VSD	SO <sub>2</sub>	1654	713,846
	VSD	PM <sub>10</sub>	1654	713,846
	VSD	NO <sub>2</sub>	1654	713,846
	VSD	CO	1654	713,846
	VSD	O <sub>3</sub>	1654	713,846
	ASD	SO <sub>2</sub>	379	715,121
	ASD	PM <sub>10</sub>	379	715,121
	ASD	NO <sub>2</sub>	379	715,121
	ASD	CO	379	715,121
	ASD	O <sub>3</sub>	379	715,121
	COA	SO <sub>2</sub>	275	715,225
	COA	PM <sub>10</sub>	275	715,225
	COA	NO <sub>2</sub>	275	715,225
Ritz <i>et al.</i> , 2002 [9]	TF	SO <sub>2</sub>	299	715,201
	TF	PM <sub>10</sub>	299	715,201
	TF	NO <sub>2</sub>	299	715,201
	VSD	CO	235	9049
	VSD	O <sub>3</sub>	235	9049
	ASD	CO	385	3000
	ASD	O <sub>3</sub>	385	3000

**Table S2.** Numbers of cases and controls of cleft lip defects in studies included in the meta analysis.

Articles	Exposure	Case	Control
Padula <i>et al.</i> , 2013 [10]	PM <sub>10</sub>	75	200
	NO <sub>2</sub>	59	205
	CO	45	157
	O <sub>3</sub>	73	201
Marshall <i>et al.</i> , 2010 [11]	PM <sub>10</sub>	92	12,925
	NO <sub>2</sub>	90	12,925
	CO	105	12,925
	O <sub>3</sub>	86	12,925
Hwang <i>et al.</i> , 2008 [12]	PM <sub>10</sub>	653	6530
	NO <sub>2</sub>	653	6530
	CO	653	6530
	O <sub>3</sub>	653	6530
Giloba <i>et al.</i> , 2005 [13]	PM <sub>10</sub>	290	3450
	NO <sub>2</sub>	285	3237
	CO	293	3309
	O <sub>3</sub>	305	3594

## References

1. Gianicolo, E.A.; Mangia, C.; Cervino, M.; Bruni, A.; Andreassi, M.G.; Latini, G. Congenital anomalies among live births in a high environmental risk area—A case-control study in Brindisi (southern Italy). *Environ. Res.* **2014**, *128*, 9–14.
2. Schembari, A.; Nieuwenhuijsen, M.J.; Salvador, J.; de Nazelle, A.; Cirach, M.; Dadvand, P.; Beelen, R.; Hoek, G.; Basagana, X.; Vrijheid, M. Traffic-related air pollution and congenital anomalies in Barcelona. *Environ. Health Perspect.* **2014**, *122*, 317–323.
3. Agay-Shay, K.; Friger, M.; Linn, S.; Peled, A.; Amitai, Y.; Peretz, C. Air pollution and congenital heart defects. *Environ. Res.* **2013**, *124*, 28–34.
4. Dadvand, P.; Rankin, J.; Rushton, S.; Pless-Mulloli, T. Ambient air pollution and congenital heart disease: A register-based study. *Environ. Res.* **2011b**, *111*, 435–441.
5. Dadvand, P.; Rankin, J.; Rushton, S.; Pless-Mulloli, T. Association between maternal exposure to ambient air pollution and congenital heart disease: A register-based spatiotemporal analysis. *Amer. J. Epidemiol.* **2011a**, *173*, 171–182.
6. Dolk, H.; Armstrong, B.; Lachowycz, K.; Vrijheid, M.; Rankin, J.; Abramsky, L.; Boyd, P.A.; Wellesley, D. Ambient air pollution and risk of congenital anomalies in England, 1991–1999. *Occup. Environ. Medicine* **2010**, *67*, 223–227.
7. Hansen, C.A.; Barnett, A.G.; Jalaludin, B.B.; Morgan, G.G. Ambient air pollution and birth defects in Brisbane, Australia. *PLoS One* **2009**, *4*, doi:10.1371/journal.pone.0005408

8. Strickland, M.J.; Klein, M.; Correa, A.; Reller, M.D.; Mahle, W.T.; Riehle-Colarusso, T.J.; Botto, L.D.; Flanders, W.D.; Mulholland, J.A.; Siffel, C.; *et al.* Ambient air pollution and cardiovascular malformations in Atlanta, Georgia, 1986–2003. *Amer. J. Epidemiol.* **2009**, *169*, 1004–1014.
9. Ritz, B.; Yu, F.; Fruin, S.; Chapa, G.; Shaw, G.M.; Harris, J.A. Ambient air pollution and risk of birth defects in southern California. *Amer. J. Epidemiol.* **2002**, *155*, 17–25.
10. Padula, A.M.; Tager, I.B.; Carmichael, S.L.; Hammond, S.K.; Lurmann, F.; Shaw, G.M. The association of ambient air pollution and traffic exposures with selected congenital anomalies in the San Joaquin Valley of California. *Amer. J. Epidemiol.* **2013a**, *177*, 1074–1085.
11. Marshall, E.G.; Harris, G.; Wartenberg, D. Oral cleft defects and maternal exposure to ambient air pollutants in New Jersey. *Birth Defects Res. Pt. A* **2010**, *88*, 205–215.
12. Hwang, B.F.; Jaakkola, J.J.K. Ozone and other air pollutants and risk of oral clefts. *Environ. Health Perspect.* **2008**, *116*, 1411–1415.
13. Giloba, S.M.; Mendola, P.; Olshan, A.F.; Langlois, P.H.; Savitz, D.A.; Loomis, D.; Herring, A.H.; Fixler, D.E. Relation between ambient air quality and selected birth defects, seven county study, Texas, 1997–2000. *Amer. J. Epidemiol.* **2005**, *162*, 238–252.

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