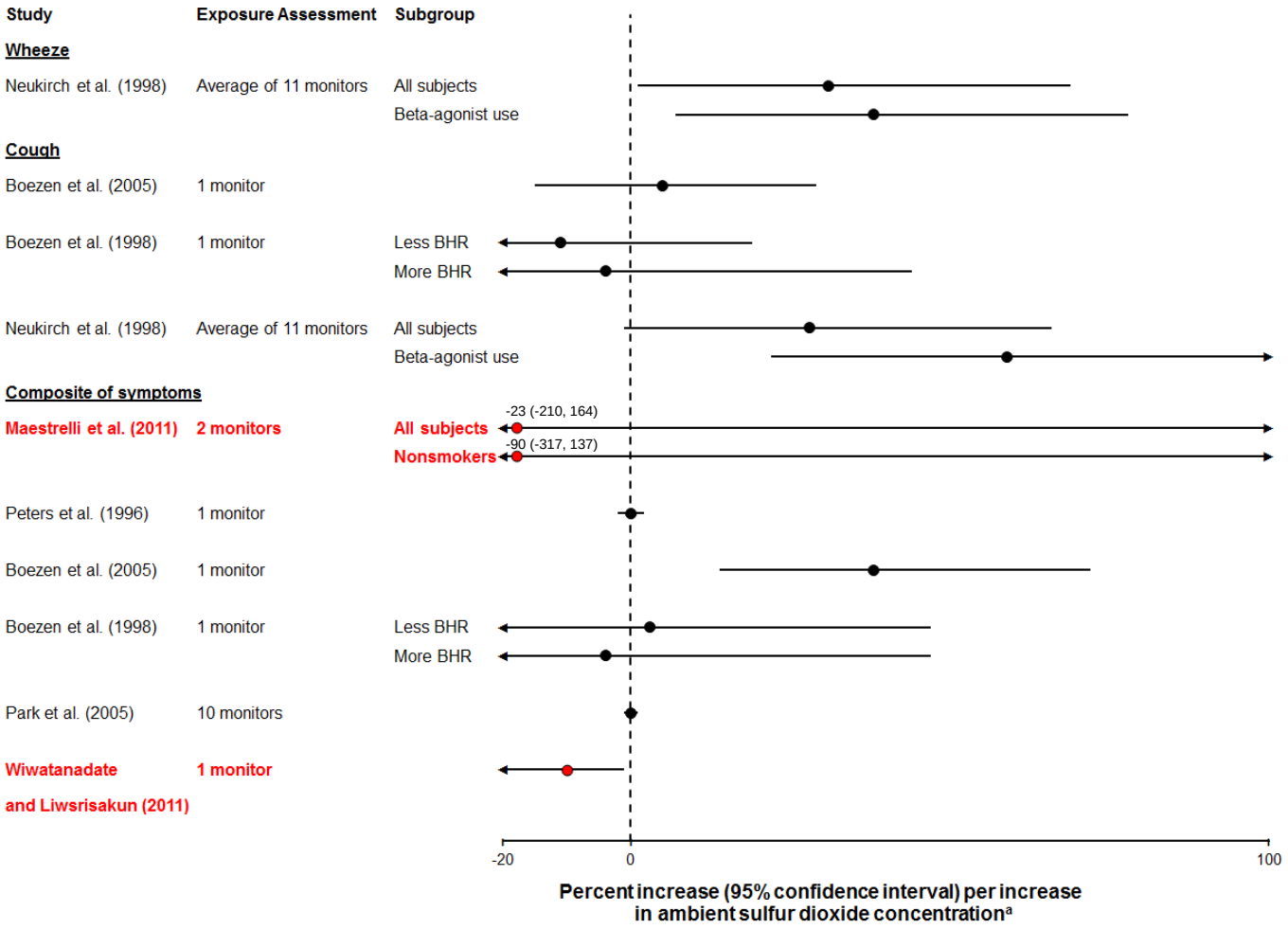

Note: Red = recent studies, black = studies from the 2008 Integrated Science Assessment for Sulfur Oxides. BHR = bronchial hyperresponsiveness, SO_2 = sulfur dioxide.
[a]Effect estimates are standardized to a 10-ppb increase in 24-hour average SO_2 concentration.

Supplemental Figure 5S-1. Associations between short-term increases in ambient sulfur dioxide concentration and respiratory symptoms in adults with asthma.

Characteristics and quantitative results for studies presented in Figure 5S-1.

Study and Location	Exposure Assessment	SO_2 Averaging Time	SO_2 Lag Day	Percent Increase (95% CI)[a]
Wheeze				
Neukirch et al. (1998) Greater Paris area, France	11 monitors averaged	24-h avg	5 3	All subjects: 31 (1, 69) Beta-agonist users: 38 (7, 78)
Cough				
Boezen et al. (2005) Amsterdam, Meppel, Nunspeet, the Netherlands	1 monitor per city	24-h avg	0	5 (−15, 29)
Boezen et al. (1998) Amsterdam, Meppel, Nunspeet, the Netherlands	1 monitor per city	24-h avg	0	Less BHR: −11 (−34, 19) More BHR: −4 (−36, 44)
Neukirch et al. (1998) Greater Paris area, France	11 monitors averaged	24-h avg	5 3	All subjects: 28 (−1, 66) Beta-agonist users: 59 (22, 106)
Composite of Symptoms				
†Maestrelli et al. (2011) Padua, Italy	2 monitors averaged	24-h avg	0	Asthma control score All subjects: 23 (−210, 164) Nonsmokers: −90 (−317, 137)
Peters et al. (1996) Erfurt, Weimar, Germany and Sokolov, Czech Republic	1 monitor per city	24-h avg	0	Deviation from mean symptom score 0 (−2, 2)
Boezen et al. (2005) Amsterdam, Meppel, Nunspeet, the Netherlands	1 monitor per city	24-h avg	1	Upper respiratory symptoms 38 (14, 72)
Boezen et al. (1998) Amsterdam, Meppel, Nunspeet, the Netherlands	1 monitor per city	24-h avg	0	Lower respiratory symptoms Less BHR: 3 (−19, 29) More BHR: −4 (−26, 29)
Park et al. (2005) Incheon, South Korea	10 monitors in city	24-h avg	0	Night symptoms 0 (−1, 1)
†Wiwatanadate and Liwsrisakun (2011) Chiang Mai, Thailand	1 monitor in city	24-h avg	2	Daytime asthma symptoms −10 (−29, −1)

avg = average, BHR = bronchial hyperresponsiveness, CI = confidence interval; km = kilometer, SO_2 = sulfur dioxide.

[a]Effect estimates are standardized to a 10-ppb increase in 24-hour average sulfur dioxide concentration.

†Studies published since the 2008 Integrated Science Assessment for Sulfur Oxides.

Boezen, HM; Vonk, JM; Van Der Zee, SC; Gerritsen, J; Hoek, G; Brunekreef, B; Schouten, JP; Postma, DS. (2005). Susceptibility to air pollution in elderly males and females. Eur Respir J 25: 1018-1024. http://dx.doi.org/10.1183/09031936.05.00076104

Boezen, M; Schouten, J; Rijcken, B; Vonk, J; Gerritsen, J; Van Der Zee, S; Hoek, G; Brunekreef, B; Postma, D. (1998). Peak expiratory flow variability, bronchial responsiveness, and susceptibility to ambient air pollution in adults. Am J Respir Crit Care Med 158: 1848-1854. http://dx.doi.org/10.1164/ajrccm.158.6.9804072

Maestrelli, P; Canova, C; Scapellato, ML; Visentin, A; Tessari, R; Bartolucci, GB; Simonato, L; Lotti, M. (2011). Personal exposure to particulate matter is associated with worse health perception in adult asthma. J Investig Allergol Clin Immunol 21: 120-128.

Neukirch, F; Segala, C; Le Moullec, Y; Korobaeff, M; Aubier, M. (1998). Short-term effects of low-level winter pollution on respiratory health of asthmatic adults. Arch Environ Occup Health 53: 320-328. http://dx.doi.org/10.1080/00039899809605716

Park, JW; Lim, YH; Kyung, SY; An, CH; Lee, SP; Jeong, SH; Ju, YS. (2005). Effects of ambient particulate matter on peak expiratory flow rates and respiratory symptoms of asthmatics during Asian dust periods in Korea. Respirology 10: 470-476. http://dx.doi.org/10.1111/j.1440-1843.2005.00728.x

Peters, A; Goldstein, IF; Beyer, U; Franke, K; Heinrich, J; Dockery, DW; Spengler, JD; Wichmann, HE. (1996). Acute health effects of exposure to high levels of air pollution in eastern Europe. Am J Epidemiol 144: 570-581. http://dx.doi.org/10.1093/oxfordjournals.aje.a008967

Wiwatanadate, P; Liwsrisakun, C. (2011). Acute effects of air pollution on peak expiratory flow rates and symptoms among asthmatic patients in Chiang Mai, Thailand. Int J Hyg Environ Health 214: 251-257. http://dx.doi.org/10.1016/j.ijheh.2011.03.003