Table 2. Epidemiologic studies of the relationship between asthma prevalence or morbidity and traffic-related exposures.

Reference ciitation	Design and location of study. Subject ages (yr) and characteristics	Exposures	Health outcomes	Results
Wjst et al. (*96*)	Cross-sectional. Munich, Germany. In school districts with multiple large roadways; 7,000–153,000 vehicles/day. Children: 9–11 yr, living in the same residence 5 years (n = 4,320 pulmonary function; 4,678 questionnaires).	Traffic density: traffic on the road with the highest traffic volume passing through the school district but no information relating to distance from home or school.	Lung function: FEV_1, FEV_1/FVC, PEF, FVC, PEFR, MEF_{25}, MEF_{50}, MEF_{75}, and MEF_{50}/FVC. Respiratory conditions: Respiratory tract infections (>10 in past year); common cold (symptoms present at exam); coughing, and recurrent conditions (bronchitis, wheezing, or dyspnea) Physician-diagnosed illness: asthma, croup, allergic rhinitis (self-reported).	Regressions controlled for parental history of asthma, parental education, passive smoking in home, number of home residents, gas or coal for cooking or heating, month of survey, and questionnaire respondent (for symptoms). Lung function models also adjusted for test compliance, height, and weight. Percent difference in lung function per 25,000 cars was significant or borderline significant ($p < 0.1$) but small (<1%) for FEV_1, PEFR, MEF_{25}, MEF_{50}, MEF_{50}/FVC. No association with MEF_{75} and FVC ($p > 0.4$). Respiratory tract infections and recurrent bronchitis were not significantly associated with traffic. Small significant associations were found for recurrent wheezing [OR/25,000 cars 1.08 (95% CI 1.01, 1.16)] and recurrent dyspnea [OR 1.10 (95% CI 1.00, 1.20)], borderline associations were found for cough [OR 1.06 (95% CI 0.99, 1.13)]. Significant association for common cold at exam suggests possible confounding of lung function. Significant small OR/25,000 cars were found for lifetime croup [OR 1.09 (95% CI 1.00, 1.18)], but asthma and allergic rhinitis were not significantly associated with traffic.
Edwards et al. (*97*)	Case–control. Birmingham, West Midlands, UK. Homes near many busy roads with traffic congestion. Children: cases 0–4 yr admitted to hospital for asthma (n = 715), versus community controls (n = 736), and versus nonrespiratory hospital controls (n = 722).	Traffic density: major roadway on or near home. Binary classification: <24,000 versus >24,000/day Ordinal classification: > 35,000; 28,000–35,000; 24,000–27,000; 20,000–23,000; 14,000–19,000; <14,000/day. Distance to roadway home within 0–200 m; 201–500 m; >500 m.	Cases admitted to hospital with asthma.	Only unadjusted results were given. Cases lived more often near roads with high traffic density than community controls [OR 1.40 (95% CI 1.13, 1.74)] and hospital controls [OR 1.29 (95% CI 1.04, 1.50)]. Ordinal traffic density showed a significant trend for subjects living < 500 m from a major road (p-value for trend <0.006). Cases were more likely to live 0–200 versus >200 m than community controls [OR 1.52 (95% CI 1.22, 1.90)], but not hospital controls [OR 1.16 (95% CI 0.94, 1.44)].
Weiland et al. (*98*)	Cross-sectional. Bocham, Germany. Children: 12–15 yr (n = 2,050) from 13 randomly selected schools.	Truck traffic density: subject self-reported frequency of truck traffic (never, seldom, frequent, and constant).	Respiratory symptoms (recalled for last year): Wheezing—written and video questionnaires (ISAAC). Allergic rhinitis symptoms—written questionnaires.	Logistic regressions controlled for age, gender, nationality, parental history of asthma, parental education, passive smoking in home, active smoking, number of siblings, single bedroom, pets, and bedroom carpets. Increased prevalence of wheezing by video questionnaire for more truck traffic: frequent versus never [OR 1.58 (95% CI 1.13, 2.20)], constant versus never [OR 1.94 (95% CI 1.26, 2.99)], consistent with ORs using written questionnaire. Increased prevalence of allergic rhinitis for frequent versus never [OR 1.67 (95% CI 1.17, 2.38)], constant versus never [OR 1.54 (95% CI 0.97, 2.44)].
Pershagen et al. (*99*)	Case–control. Stockholm, Sweden. St. Goran's Children Hospital. Children: 4–48 months (n = 197) admitted to hospital for breathing difficulties with wheezing versus 350 controls 4–48 months of age recruited from hospital catchment area; frequency matched for age.	Ambient air pollution: NO_2 (μg/m^3: <35, 35–45, 46–70, >70) predicted from dispersion models involving traffic data near the home and day care center, background ambient NO_2, and time in months at home and day care addresses.	Cases diagnosed with wheezing bronchitis (from administrative data).	Logistic regressions controlled for parental asthma and maternal smoking.Cases had higher predicted NO_2 exposures than controls, restricted to girls only: Ordinal p for trend <0.02; OR for >70 versus <35 μg/m^3 NO_2: 2.7 (95% CI 1.1, 6.8).
Waldron et al. (*100*)	Cross-sectional. East Surrey, Great Britain. Rural and urban wards with and without motorways. Children: 13–14 yr (n = 2,324).	Traffic density: Binary classification of wards: motorway versus nonmotorway. There was no definition of motorway, and a ward was classified as motorway if any part of the motorway passed through it.	Respiratory symptoms: Ever wheezing; in past year: wheezing, sleep disturbance from wheeze, speech limitation from wheeze, wheeze after exercise, dry cough at night, and ≥4 wheezing attacks. Physician-diagnosed asthma (self-reported).	Unadjusted comparisons only with chi-square tests showed no associations in relation to wards having versus not having a motorway.
Duhme et al. (*101*)	Cross-sectional. Münster, NW Germany. Administrative city with few industrial areas; urban and rural settings sampled with various traffic densities. Children: 12–15 yr (n = 3,703).	Traffic density: self-reported frequency of truck traffic near home (never, seldom, frequent, and constant). Traffic noise: self-reported frequency of intense traffic noise near home (never, seldom, frequent, and constant).	Respiratory symptoms (recalled for last year): Wheezing—written and video questionnaires (ISAAC). Allergic rhinitis symptoms—written questionnaires.	Logistic regressions controlled for age, gender, parental history of asthma, passive smoking at home, and active smoking. Found increased prevalence of wheezing by video questionnaire for more truck traffic: frequent versus never [OR 1.35 (95% CI 1.04, 1.77)], constant versus never [OR 1.94 (95% CI 1.33, 2.84)]. Effects using written questionnaire responses were consistent. Consistent significant trends with ordinal intense traffic noise. Found increased age- and gender-adjusted prevalence of allergic rhinitis for children; frequent versus never [OR 1.71 (95% CI 1.36, 2.15)], constant versus never [OR 1.96 (95% CI 1.40, 2.76)]. Consistent significant trends with ordinal intense traffic noise. Effect modification of allergic rhinitis risk seen for duration: association only found for subpopulation >5 yr in present home

(Continued)

Table 2. *Continued.*

Reference citation	Design and location of study. Subject ages (yr) and characteristics	Exposures	Health outcomes	Results
Brunekreef et al. (*102*)	Cross-sectional. Netherlands, Province of South Holland. Six residential areas with homes near major freeways; 80,000–152,000 vehicles/day. Children: 7–12 yr, lived within 1,000 m of freeway assessed in 1995 (n = 778), [subset of van Vliet et al. (*103*) below]; 85% lived at current residence for 3 or more years.	Annual (1993) truck traffic density per region and school. Annual (1993) auto traffic density per region and school. Distance home to freeway: ≤100 m versus >100 m. Indoor school air pollution: NO_2, black smoke.	Lung function: FEV_1, PEF, FVC, and $FEV_{25–75\%}$.	Regressions controlled for age, gender, smoking in home, pets, home dampness or mold, ethnicity, number of home residents, gas cooking, gas unvented water heaters, and parental education. Home within 100 m versus >100 m of freeway not significant. Deficits found for truck (not auto) traffic density, and deficits larger for children living within 300 m of freeway: for 10,000 trucks/day FEV_1, –4.1 (95% CI –7.9, 0.1); FVC, –3.6 (95% CI –7.4, 0.3). Pollutant-related deficits larger for children living within 300 m of freeway, and significant deficits for black smoke: per 10 μg/m^3, FEV_1, –3.7 (95% CI –7.7, –0.2); FVC, –2.7 (95% CI –6.1, 0.9); $FEV_{25–75\%}$, –6.3 (95% CI –13.2, 1.2). Similar deficits for PEF. NO_2 significant only for $FEV_{25–75\%}$ per 10 μg/m^3: –3.6 (95% CI –7.1, –0.1). Deficits larger in girls than boys; for 10,000 trucks/day FEV_1 for boys: –1.8 (95% CI –7.5, 4.2); girls, –8.3 (95% CI –13.0, –3.4).
van Vliet et al. (*103*)	Cross-sectional. Netherlands, Province of South Holland. Six residential regions with homes near major freeways: 80,000–152,000 vehicles/day. Children: 7–12 yr, lived within 1,000 m of freeway assessed in 1995 (n = 878). 85% lived at current residence for 3 or more years.	Annual (1993) truck traffic density per region and school. Annual (1993) auto traffic density per region and school. Distance home to freeway: ≤100 m versus >100 m. Indoor school air pollution: NO_2, black smoke.	Respiratory symptoms: chronic cough, wheezing, asthma attacks, rhinitis. Physician-diagnosed illness: asthma, bronchitis (self-reported). Physician diagnosed allergy to pets, dust mites, pollen (self-reported).	Logistic regressions controlled for age, gender, smoking in home, pets, home dampness or mold, ethnicity, number of home residents, gas cooking, gas unvented water heaters, and parental education. Associations found in girls not boys: For truck (not auto) traffic density (per 9,482 vehicles/day) and wheeze [OR 3.42 (95% CI 0.98, 11.9)] and asthma attacks [OR 4.34 (95% CI 1.12, 16.8)]. Home within 100 m of freeway and chronic cough [OR 2.45; 95% CI 1.16, 5.16), wheeze [OR 3.05 (95% CI 1.11, 8.41)], and rhinitis [OR 2.30 (95% CI 0.96, 5.52)]. Black smoke and chronic cough [OR 2.94 (95% CI 0.98, 8.83)], and rhinitis [OR 3.06 (95% CI 0.87, 10.8)]. NO_2 not significant. Physician-diagnosed asthma was not associated with increased exposure, but fewer persons with asthma lived near high traffic density freeways. Physician-diagnosed allergy was inversely associated with NO_2 and black smoke.
Ciccone et al. (*104*)	Cross-sectional. Ten sites in northern and central Italy with rural and urban settings, including three large cities: Torino, Milan, and Rome. Children: 6–7 yr (n = 18,737); 13–14 yr (n = 21,067). 53.3% of subjects had never moved from home since birth.	Traffic density: self-reported frequency of traffic near home (absent, low, moderate, and high). Self-reported number of bus routes near home (0, 1, and ≥2). Self-reported truck transit near home (never or seldom, sometimes, and often).	Respiratory disease (first 2 years of life): bronchitis (>three episodes), pneumonia, bronchiolitis, spastic laryngitis, wheezing bronchitis (>three episodes), none of the diseases listed (reference group). Respiratory symptoms (past year): wheeze, severe cough, dyspnea + wheeze, morning chest tightness, conditions apart from colds (nocturnal dry coughs, persistent cough, persistent cough > 2 months, persistent phlegm > 2 months), none of the conditions listed (reference group). Physician-diagnosed illness: current asthma, asthma attack that resulted in hospitalization (self-reported).	Logistic regressions controlled for age, gender, study center, change of residence, parental history of asthma, parental education, smoking (self, mother, father, others), number of home residents, gas cooking, heating system, month of survey, maternal smoking, bedroom (dampness, mold, bedding), floor level. No significant associations for overall traffic density. Significant positive associations found for metropolitan areas for combined respiratory diseases first 2 yr of life with bus routes and truck transit: OR for often versus never truck traffic 1.39 (95% CI 1.19, 1.62); consistently positive associations across individual respiratory diseases. Positive associations found for combined respiratory symptoms the last year plus illnesses and bus routes and truck transit: OR for often versus never truck traffic 1.29 (95% CI 1.15, 1.45); consistently positive associations across individual current respiratory conditions. OR for current asthma and truck traffic, often versus never: 1.25 (95% CI 0.99, 1.59), which was higher in children with persistent cough and phlegm for 2 months [OR 1.70 (95% CI 1.11, 2.61)]. Asthma hospitalizations (n = 36) were not associated with exposure.
English et al. (*105*)	Case–control. San Diego, Califonia, USA. Children: ≤14 yr; 5,996 cases diagnosed with *ICD-9* code for asthma in the 1993 California Medicaid claims database, including pharmacy visits; 2,284 random nonrespiratory control claims.	Traffic density: average weekday traffic density within a 550-ft radius around home using GIS on the street with highest volume, the closest street, and the sum of all streets weighted using dispersion models without wind data.	Cases diagnosed with asthma on Medicaid claims. Case-based analysis: cases with ≥2 versus 1 medical visit per year of study.	Logistic regressions controlled for race, medical visit type, and urban/rural residence. Case–control: there were no significant associations and all ORs were close to 1.00 with wide confidence intervals. No differences were found in separate models by gender or excluding accident controls. Case-based: there were elevated ORs for each quintile of traffic flow on the nearest street; no evidence of dose-response. OR for case having two or more visits versus one with traffic flows > 41,000 cars/day (95th percentile): 2.91 (95% CI 1.23, 6.91).

(Continued)

Table 2. *Continued.*

Reference citation	Design and location of study Subject ages (yr) and characteristics	Exposures	Health outcomes	Results
Guo et al. (*106*)	Cross-sectional. Taiwan. Children: middle school students attending schools located within 2 km of 55 air pollution monitoring stations (n = 331,686). Excluded active smokers.	Ambient air pollution: annual mean from 55 monitoring sites. Principal component analysis factors: Factor 1: positively associated with CO and NO_x, negatively associated with O_3 - "traffic related." Factor 2: positively associated with SO_2, and PM_{10} - "industry, power plants, domestic fuel." Weather: annual mean temperature and RH.	Physician-diagnosed asthma (self-reported). Questionnaire-determined asthma from student video questionnaire (ISAAC)[a] report of dyspnea and nocturnal dyspnea associated with wheezing, or parent-reported attacks of dyspnea with wheezing, or parent-reported physician-diagnosed asthma.	Two-stage logistic regression. First stage: site-specific asthma prevalences were adjusted for age, history of atopic eczema, and parental education in each of 55 monitoring catchments sites. Second stage: site-specific asthma prevalences rates were adjusted for temperature and relative humidity to assess effects of air pollutant factor scores. Factor 1 was positively associated with physician-diagnosed asthma in boys and girls ($p < 0.001$) and with questionnaire-determined asthma in boys and girls ($p < 0.01$). For an inter-quartile increase in CO (326 ppb) and in NO_x (17.3 ppb), the prevalence of either physician-diagnosed or questionnaire-based asthma increased around 1% for both boys and girls Parameters for factor 2 were negative for all models.
Hirsch et al (*107*)	Cross-sectional. Dresden, SE Germany. Children: 5–7 yr (n = 2,796) 9–11 yr (n = 2,625), who lived in Dresden 12 or more months. Random subsamples of 5- to 7-yr olds and all 9- to 11-yr olds were used for SPT (n = 1,138 and 2,050, respectively) and serum IgE (n = 870 and 1,887, respectively). Random subsamples of 9- to 11-yr olds were used for lung function (n = 1,137) and BHR (n = 956).	Ambient air pollution: SO_2, NO_2, CO, benzene, O_3 measured for 1 yr in 182 1-km^2 grids across urban Dresden and geocoded and weighted to the subject's school and home addresses. Traffic density: parent-reported frequency of truck traffic near home.	Respiratory symptoms: wheezing, morning cough last year. Atopic symptoms: Rhinoconjunctivitis, symptoms of atopic eczema. Physician-diagnosed illness: Asthma, bronchitis (self-reported). Atopic sensitization: SPT, specific IgE antibodies. Lung function: FEV_1, $FEF_{25–75\%}$. BHR	Logistic regressions controlled for age group, birth weight, central heating, maternal smoking, pets, home dampness, carpets, floor level, parental education. Wheeze last 12 months was not associated with exposures. Morning cough was positively associated with SO_2, NO_2, CO, and benzene inversely with O_3. Per 1 $\mu g/m^3$ benzene at home plus school OR 1.21 (95% CI 1.04, 1.40). OR from constant truck traffic versus none: for cough, 1.60 (95% CI 1.06, 2.42), for wheeze, 2.09 (95% CI 1.24, 3.53). Tendency for increased prevalence of asthma, but significant only for benzene: OR 1.21 (95% CI 1.01, 1.45). However, in subgroup models, effects on asthma prevalence were significant for nonatopic, children from SO_2, NO_2, CO, and benzene (lower 95% CI ≥ 1.00; ORs 1.29–1.49). Significant increase in prevalence of bronchitis for NO_2, CO, and benzene (ORs 1.16–1.27). No association with prevalence of atopic symptoms, atopic sensitization lung function, or BHR.
Wilkinson et al. (*108*)	Case–control. North Thames (West), UK. Children: 5–14 yr 1,380 cases with Emergency admissions for *ICD-9* code for asthma; 2,131 cases all *ICD-9* respiratory admissions including asthma; 5,703 controls with nonrespiratory admissions excluding accident.	Traffic density: modeled vehicle meters/hr along roads within 150 m of the postcode centroid of home, linked by GIS. Distance: from postcode centroid of home to nearest main road (>150 m versus. ≤ 150 m); and to nearest road with modeled peak > 1,000 vehicle-meters/hr.	Cases admitted to hospital with asthma (from administrative data). Cases admitted to hospital with any respiratory illness (from administrative data).	Logistic regressions controlled for age, gender, hospital, and average census tract SES. For both asthma and all respiratory admissions there was no significant difference for traffic density or distance to nearest main road. For asthma, a borderline ($p < 0.06$) decreasing risk with increasing traffic was seen. No differences were found in separate models by gender.
Krämer et al. (*109*)	Cross-sectional, as well as, prospective outcome assessment of atopic symptoms for 1 yr along with NO_2. Dusseldorf, W. Germany. Two urban areas near major roads and one suburban area. Children: 9 yr (n = 306); urban = 204; suburban = 102; lived 2 or more yr at same home.	Ambient air pollution. Palmes tubes passively sampled NO_2 at 158 locations for 1 week in each of 4 seasons. Palmes tubes were used for other NO_2 samples in March and September 1996. Analytic variables are interpolated outdoor NO_2 from 158 sites and predicted personal NO_2 from actual personal and micro-environmental NO_2.	Respiratory symptoms: wheezing and allergic rhinitis symptoms reported weekly in diaries over 1 yr. Physician-diagnosed illness: asthma, hay fever, eczema (self-reported). Atopic sensitization: SPT (pollen, dust mites/cats, and milk or eggs); serum (IgE antibodies).	Logistic regressions controlled for older siblings, gender, and education of parents. Associations were dominated by urban subgroup as follows: Outdoor NO_2, but not personal NO_2, was significantly associated with reports of at least 1 week with symptoms of wheezing [OR for 10-$\mu g/m^3$ increase: 14.9 (95% CI 2.59, 86.4)] and with symptoms of allergic rhinitis [OR 1.81 (95% CI 1.02, 3.21)], which in pollen season increased to OR 3.09 (95% CI 1.38, 6.92). An ever diagnosis of hay fever was associated with outdoor NO_2 [OR 4.24 (95% CI 1.01, 17.8)]; asthma was not [OR 1.82 (95% CI 0.36, 9.36)]. Atopic sensitization to pollen, house dust mite or cat, and milk or egg were each significantly associated with outdoor NO_2 (ORs ranged from 3.5 to 5.0), but not personal NO_2. (See text and Figure 2.)
Venn et al. (*110*)	Cross-sectional. Case–control selected within initial survey. A cohort subset was taken from historical data on wheeze 7 years previously. Nottingham area, United Kingdom. Children: Survey: 4–11 yr (n = 22,986) 11–16 yr (n = 27,826). Case–control: 2,648 cases of all children reporting wheeze, versus random sample of 3,928 controls without recent wheeze. Cohort: 765 adolescents in both old and new survey.	Traffic density (24 hr): TAI (meters traveled/day/km^2) for 1 km^2 around subject's school; no information relating to distance from home. TAI tertile (in millions): low ≤ 22; medium 23–31; high ≥ 32.	Respiratory symptoms: past year attacks of wheeze and presence of troublesome cough (especially at night) apart from cold or chest infection. Physician-diagnosed illness: asthma (self-reported).	Prevalence of wheeze adjusted for age and sex in subjects 4–11 yr was not associated with continuous TAI, but was associated with middle and upper versus lower tertile [OR 1.11 (95% CI 1.02, 1.22) and 1.13 (95% CI 1.03, 1.24), respectively]. Prevalence of cough adjusted for age and sex in subjects 4–11 yr was also nonlinearly associated with the middle and upper versus lower tertile TAI [OR 1.21 (95% CI 1.02, 1.44) and 1.22 (95% CI 1.02, 1.45), respectively]. Prevalence of asthma adjusted for age and sex in subjects 4–11 yr was also nonlinearly associated with the middle and upper versus lower tertile TAI [OR 1.16 (95% CI 1.02, 1.31) and 1.16 (95% CI 1.02, 1.32), respectively]. In subjects 11–16 yr there was no association of wheeze, cough, or asthma with either continuous TAI or tertiles. ORs for wheeze, cough, and asthma in case–control sample adjusted for age, sex, social class, and maternal smoking were positive but not significant. Weak linear relationship of persistent wheeze in cohort sample with TAI (p = 0.06); OR 1.05 (95% CI 1.00, 1.11) per 10 million TAI units.

(Continued)

Table 2. *Continued.*

Reference citation	Design and location of study. Subject ages (yr) and characteristics	Exposures	Health outcomes	Results
Oosterlee et al. (*115*)	Cross-sectional. Haarlem, Netherlands. Children: 106 children (0–15 yr) living along busy traffic streets (72% born in same house) compared with 185 control children living along streets with little traffic, same neighborhoods, same housing type (66% born in same house). Adults: 673 adults living along busy traffic streets compared with 812 controls as above.	Traffic classification: binary; busy streets versus quiet streets predicted with model calculations of NO_2 concentrations based on detailed traffic data including traffic density (CAR model) (*117*); estimated traffic density on busy streets 10,000–30,000 vehicles/day.	Respiratory symptoms: chronic cough, cough with phlegm, dyspnea (ever/in past year), wheeze (ever/in past year), dyspnea with wheeze (ever/in past year). Medication: asthma medication currently; respiratory medication ever. Physician-diagnosed illness: asthma, allergy (self-reported).	Logistic regressions controlled for age, sex, education of mother, change of residence, parental history of asthma, passive smoking, presence of an unvented gas hot water heater, number of home residents, gas cooking, type of heating system, pets, and home humidity. Children: too few with asthma, chronic cough, or cough with phlegm to analyze. Seven of 9 other ORs ranged from 1.5 to 4.8; only ever respiratory medication was significant, and ever wheezing was $p < 0.06$. Effects were dominant in girls and most significant: wheeze in past year [OR 5.3 (95% CI 1.1, 25.0)], attacks of dyspnea with wheeze in past year [OR 15.8 (95% CI 1.4, 174)]. Physician-diagnosed allergy not associated with traffic. Adults: only dyspnea while walking significant: OR 1.8 (95% CI 1.1, 3.0).
Nitta et al. (*111*)	Cross-sectional, three surveys. Western suburbs of Tokyo, Japan. Three areas with homes near major roadways; 30,000–53,000 vehicles/12-hr day. Adults: Women only, 40 yr of age or older: 1979 ($n = 1,517$), 1982 ($n = 2,413$), and 1983 ($n = 2,389$). Lived 3 or more yr at same home.	Distance to major roadway: <20 m versus 20–150 m for 1979 and 1983; <20 m versus 20–50 m, and versus 50–150 m for 1982. Confirmed gradient difference with 2–7/day average. NO and NO_2.	Respiratory symptoms: chronic wheeze most days or nights apart from colds, chronic cough or chronic phlegm 3 or more months last year, dyspnea with walking, off work with chest illness with phlegm in last 3 yr.	Logistic regressions controlled for age, smoking status, years at residence, education, occupation, and type of home heating. 1979: all five ORs >1.0, ranging from 1.35 to 2.75, and all but one symptom (dyspnea) was significant. 1982: four of five ORs >1.0, ranging from 1.13 to 1.87; only (OR 1.87) was significant for <20 m versus 20–50 m, and only chronic cough (OR 1.78) and phlegm (OR 1.85) were significant for <20 m versus 50–150 m. 1983: Three of five ORs > 1.0, ranging from 1.26 to 1.66; only dyspnea was significant (OR 1.66).
Nakai et al. (*112*)	Cross-sectional. Repeated measures for lung function. Tokyo, Japan. Areas within varying distances from roads with heavy traffic: 30,000–34,000 vehicles/12-hr day (<21% diesel powered), versus referent area away from roads with heavy traffic. Adults: women only, 39–59 yr ($n = 1,986$). Lived 3 or more yr at same home.	Distance home to major roadway: Zone A = 0–20 m; B = 20–150 m; C = reference zone in suburbs. Confirmed gradient difference with NO_2 (passive indoor, personal, and outdoor at 0, 20, and 150 m from roadside) 2 days each in 10 seasons, fall 1987 to winter 1990. Personal NO_2 exposures were primarily attributable to traffic if no gas stoves in the home, as reported in Nakai et al. (*116*).	Respiratory symptoms: Chronic wheeze most days or nights apart from colds, chronic cough or chronic phlegm 3 or more months last year, dyspnea with walking. Lung function: age-and height adjusted FEV_1, FVC in subsample of 200 nonsmoking women without history of respiratory disease; repeated measurements each of 10 seasons.	Logistic regressions controlled for age, smoking status, years at residence, occupation, and type of home heating. Prevalence of chronic cough and chronic phlegm were higher in zone A than C [OR 2.18 (95% CI 1.08, 4.42) and OR 1.79 (95% CI 1.07, 3.01), respectively]. Chronic cough was higher in zone A than B [OR 1.87 (95% CI 1.02, 3.42)]. Zone B did not differ from C. There were no consistent differences for wheeze or dyspnea. Longitudinal mixed regression models for lung function decline showed no consistent differences by zone.
Montnémery et al. (*114*)	Cross-sectional. Malmöhus and Skåne counties, Sweden. Adults: random sample by age deciles 20–59 yr.	Traffic classification: Binary. "Yes" versus "no" to question "Do you live close to a road with heavy traffic?"	Respiratory symptoms: Asthma symptoms last 12 months including dyspnea with or without cough or wheeze; long-standing cough last year. Physician-diagnosed illness: asthma (self-reported).	Symptom prevalence rates were adjusted for age and gender by direct standardization to county. Comparing subjects living close versus those not to living close to heavy traffic, asthma symptoms were more prevalent (10.5 vs. 8.4%, respectively; $p = 0.001$) and long-standing cough was also more prevalent (15.9 vs. 10.5%, respectively; $p = 0.001$). Logistic regressions on asthma diagnosis controlled for age, gender, and smoking behavior. Asthma diagnosis was significantly associated with living close to heavy traffic [OR 1.29 (95% CI 1.02, 1.62)].
Wyler et al. (*113*)	Cross-sectional. Basel-Stadt, NW Switzerland. Traffic "decimals" ranged from 24 to 32,504 vehicles/day. Adults: 18–60 yr (mean 41.1); $n = 820$. Known residence time at same address incorporated into analysis: 1–9 yr versus ≥10 yr	Traffic density on street of home address: Cars per 24 hr: 24–710; 711–1,620; 1,621–5,250; 5,251–32,504 Trucks per 24 hr: 0–20, 21–100, 101–360, 361–4,744.	Respiratory symptoms: hay fever past 2 yr; ever symptoms of seasonal rhinitis or conjunctivitis when exposed to pollen; ever seasonal asthma symptoms of cough or wheeze or chest tightness or dyspnea when exposed to pollen. Atopic sensitization: SPT for local pollen (timothy grass, birch, pellitory-of-the-wall), dust mite, cat, dog, fungi (cladosporium, alternaria).	Logistic regressions controlled for age, gender, smoking behavior, education, number of siblings, and family history of atopy. There were no associations between any respiratory symptoms and traffic density. Sensitization to pollen: ordinal comparisons to lowest car density showed a significant trend, with larger effects for resident living in same home ≥10 yr: OR 1.99 (95% CI 0.91, 4.38), OR 2.47 (95% CI 1.06, 5.73), OR 2.83 (95% CI 1.26, 6.31). Effects were similar for truck traffic. Effects were larger for women than men. Sensitization to indoor allergens (dust mite, cat, dog): no significant trends were found.

Abbreviations: BHR, bronchial hyperresponsiveness; *ICD-9, International Classification of Diseases, 9th Revision*; ISAAC: International Study of Asthma and Allergies in Childhood; MEF, maximal expiratory flow rates when, as indicated by subscripts, 25%, 50%, or 75% of forced vital capacity has expired; PEFR, peak expiratory flow rate; SPT, skin prick test; TAI, traffic activity index.