Proximity of Licensed Child Care Facilities to Near-Roadway Vehicle Pollution

Douglas Houston, MA, Paul Ong, PhD, Jun Wu, PhD, and Arthur Winer, PhD

Objectives. We assessed child care facilities' proximity to heavily traveled roadways in an attempt to estimate the extent of potential exposure of young children to vehicle-related pollution in this understudied microenvironment.

Methods. We examined approximately 24 000 licensed child care facilities in California located within 200 m of heavily traveled roadways.

Results. Approximately 57 000 of the available slots in California child care centers (7% of the overall capacity) are in facilities located within 200 m (650 ft) of roadways averaging 50 000 or more vehicles per day, and another 172 000 (21%) are in facilities located within 200 m of roadways averaging 25 000 to 49 000 vehicles per day. Facilities providing care to infants or preschool-aged children and facilities located in disadvantaged areas were more often situated in medium- or high-traffic areas.

Conclusions. Additional research is needed to further clarify the significance of the child care microenvironment in terms of potential childhood exposures to vehicle-related pollutants. Design strategies, notification standards, and distance-based siting restrictions should be considered in the facility licensing process and in land use and transportation planning. (*Am J Public Health.* 2006;96: 1611–1617. doi:10.2105/AJPH.2005.077727)

Given the potential significance of the child care microenvironment for young children's overall air pollution exposure, there is a need for new insight into the extent to which child care facilities are located in near-roadway areas with potentially high concentrations of harmful vehicle-related pollutants. Young children are particularly susceptible to air pollution given their narrow airways, higher breathing rates, and developing lungs and immune systems. Few studies, however, have examined air pollution effects among toddlers and preschool-aged children, in part because few registries exist for children 1 to 5 years of age.

Available evidence shows that, among girls aged 4 months to 4 years, exposure to nitrogen dioxide (NO_2) near their home or day care center may be associated with the development of wheezing bronchitis[1]; higher levels of traffic-related air pollutants (NO_2, $PM_{2.5}$ [particulate matter 2.5 micrometers or smaller in size], and "soot") are associated with wheezing, physician-diagnosed asthma, flu, serious colds, and ear, nose, and throat infections[2]; and exposure to air pollution (including NO_2), particularly in combination with exposure to environmental tobacco smoke, increases the risk of recurrent wheezing in children.[3] A study of infants revealed significant associations between traffic-related air pollutants ($PM_{2.5}$ and NO_2) and cough without infection and dry cough at night in the first year of life.[4]

Recent studies suggest that vehicle-related pollutants and associated health effects in children are highly concentrated near heavily traveled roadways. Ultrafine particles, black carbon, and carbon monoxide drop to near-background levels at 200 m (650 ft) downwind from major roadways and are indistinguishable from background concentrations at 300 m downwind.[5,6] An analysis of hospital admissions among children younger than 5 years in Great Britain revealed that children admitted with an asthma diagnosis were significantly more likely than children admitted for nonrespiratory reasons or children from other parts of the community to live less than 500 m from a roadway with high traffic flow (more than 24 000 vehicles per day).[38] Another study showed that children of color residing in California were 3 to 4 times more likely to reside in high-traffic areas than White children, and the potential for exposure to vehicle-related pollution was higher among low-income children.[7]

Previous exposure assessment and time activity studies have demonstrated that significant exposures of infants and children to air pollution can occur at home as a result of indoor pollutants produced by environmental tobacco smoke, cooking, and cleaning; such exposures can also stem from outdoor sources through the intrusion of outdoor air.[8–15] Outdoor air pollutant concentrations may be heightened in homes in close proximity to major roadways, and children may also experience significant exposures in other microenvironments such as portable classrooms,[16] school buses,[17] and passenger vehicles.[18]

Although children only spend a portion of their day in child care facilities or preschools, the hours spent in these facilities could represent a significant proportion of their overall daily exposure to air pollution, especially if they spend part of the day in moderate or rigorous play outdoors in high-traffic areas. Because many working parents rely on child care, the hours a child spends in a care facility often correspond to the morning or afternoon periods of peak traffic volumes when pollution levels near roadways are most elevated.

Given the potential significance of the child care microenvironment for a child's overall exposure to air pollution, we assessed the degree to which child care facilities are in close proximity to heavily traveled roadways. To our knowledge, our analyses provide the first estimations of the degree to which young children may be exposed to vehicle-related pollution in this understudied microenvironment, and these estimates have important implications for facility licensing and siting as well as transportation and land-use planning nationwide. Furthermore, an understanding of exposures of children in the child care microenvironment is especially important given initiatives in California and other states to substantially expand existing child care and preschool systems to ensure that all children aged 1 to 5 years receive early education before entering kindergarten.

METHODS

Numerous epidemiological studies have used traffic densities and distance criteria to estimate exposures to vehicle-related pollutants.[19–27] Short of direct experimental measurements of vehicle emissions and individual exposure, traffic densities and distance provide a valid proxy for potential exposures to vehicle-related pollution at a neighborhood, site, or individual level. We identified maximum traffic volumes near licensed child care facilities in California in an attempt to approximate potential magnitudes of exposure to vehicle-related pollution among young children at these facilities.

We used data from the year 2000 on traffic volumes and child care facilities in California. We obtained traffic volume data from the Highway Performance and Monitoring System maintained by the California Department of Transportation (CalTrans). These data have been used and described in previous studies on the distribution and effects of traffic in California.[7,20,27–30] Using electronic counting instruments, CalTrans samples traffic volumes on major roadways throughout the state at infrequent intervals and then adjusts these counts for estimated seasonal traffic fluctuations, weekly variations, and other variables to estimate annual average daily traffic (AADT), or an individual roadway segment's estimated total volume for the year divided by 365 days. These data contain traffic counts for freeways, highways, and major arterial roads, but they do not include counts for local residential streets or distinguish traffic according to vehicle fuel type. Because residential streets tend to have lower traffic volumes, we did not expect their exclusion to significantly affect our results.

We obtained data on facilities licensed to provide child care in California from the Community Care Licensing Facility of the California Department of Social Services. We included approximately 13 100 child care centers and approximately 11 000 large family care homes in our analyses. Each center's capacity was defined as the total number of slots available for infants (younger than 2 years), preschoolers (between 2 and 5 years old), or school-aged children (6 years or older). If a given facility was licensed to provide care to children in more than 1 of these age categories, it was included separately in each category in the California data and in our analyses. The large family care homes assessed here had a capacity of 8 to 14 children. Information on the remaining family care homes, which had a capacity of fewer than 8 children and represented approximately 70% of licensed family care homes in the state, was not available as a result of confidentiality concerns.

Because segment-level CalTrans traffic volume data are not adequate for geocoding address locations, we geocoded child care centers with Topologically Integrated Geographic Encoding and Referencing (TIGER; US Census Bureau) roadway data with an average offset from roadway center lines of 13.5 m. We obtained data on geographic locations of licensed child care facilities from the California Transportation Needs Assessment project[31]; approximately 92% of facilities included in this database had valid addresses and were geocoded. Use of a standard offset may result in misclassifications in cases in which a facility's distance from the roadway center line significantly varies from this distance. Misclassifications can also result from other issues relating to the spatial accuracy of the geocoding process.[32–36]

We transformed the CalTrans traffic data and geocoded facility data into a common geographic projection, Universal Transverse Mercator, so that we could construct geographic overlays and make consistent distance calculations. We identified all CalTrans roadway segments within 200 m of facilities because this distance corresponds closely with the distance from major roadways at which vehicle-related air pollutants drop to near-background concentration levels.[5,6,37] In the case of each child care facility, we identified the segment with the highest AADT and assigned this maximum AADT value to the facility as an approximation of the highest level of traffic volume near the facility on an average day.

Although the distance and traffic volume thresholds used in available studies vary, they suggest that a proximity of 100 m to 500 m from roadways with a traffic volume of approximately 24 000 or more vehicles per day is associated with adverse effects.[24,38–40] As did Green et al.,[28] we classified child care facilities with a maximum nearby AADT of 50 000 or more vehicles per day as being located in high-traffic areas, facilities with a maximum nearby AADT between 25 000 and 49 999 as being located in medium-traffic areas, and facilities with a maximum nearby AADT below 25 000 AADT as being located in low-traffic areas. Facilities with no attributable traffic within 200 m were considered to be located in very-low-traffic areas. These classifications may underestimate traffic volumes for facilities with 2 or more nearby moderate-traffic roadway segments that, when combined, produce relatively high overall volumes.

Previous studies have shown that CalTrans line segments do not align perfectly with the TIGER roadway data used to geocode child care facilities. Such misalignment could result in misclassifications of nearby traffic volumes.[7,27,28,30] In the current study, the average discrepancy between 2 street segments in Los Angeles County was 13.3 m, with a standard deviation of 19.5 m. Two earlier studies addressed this discrepancy by transferring AADT values from CalTrans line segments to Los Angeles County TIGER-based line segments,[27,30] and one of these studies suggested that misclassifications were minimized at distances above 150 m.[30]

Although a similar reassignment was not feasible on a statewide scale, we used the same technique to assess the magnitudes of potential misclassifications in Los Angeles County. At a threshold distance of 200 m, 41 more facilities (or 0.2% of all facilities) were classified in the medium- and high-traffic categories when uncorrected data were used than when corrected data were used. Given that this potential error was small and did not change the overall percentage of facilities in these categories, we assumed that positional errors because of segment misalignment were randomly distributed in the state and did not cause differential aggregate-level misclassification at a 200 m threshold.

We estimated the number of young children potentially exposed to vehicle-related pollution on the basis of numbers of child care slots in facilities with a medium- or high-traffic roadway within 200 m. We identified traffic levels according to facility capacity category and type of facility: large family care home with a capacity of 8 or more children, infant care center, center providing care for preschool-aged children, or center providing care for school-aged children. We determined the 2000 census block group in which a facility was located by overlaying the facility's location with TIGER block-group area boundaries, which are smaller than census tracts and often correspond with major roads, bodies of water, or railroads. Census block groups contain an average of about 1500 people; their size can vary depending on land use and population density.

We used census-based area characteristics to derive several block-group classifications that allowed us to assess potential effects on disadvantaged communities. These classifications were as follows: minority area (more than 50% non-White residents), Black area (more than 50% African American or Black residents), Latino area (more than 50% Hispanic residents), poor area (more than 20% of residents living in poverty), foreign-born area (more than 35% of residents born outside the United States), limited English area (more than 15% of residents with limited English proficiency), and limited education area (more than 35% with less than a high-school education).

We also examined the built environments near facilities, including nearby population density, employment density (number of private-sector jobs per square mile in a facility's tract, derived from the American Business Information database), types of residential parcels, and presence of a highway. We used data from the Statewide Database of the University of California at Berkeley to determine the distribution of residential parcels at the block-group level in 2001, including single-family and multifamily parcels.

In addition to descriptive analyses, we conducted a polytomous logistic regression analysis to model the odds of a facility being located in a medium-traffic area versus a low- or very-low-traffic area and the odds of a facility being located in a high-traffic area versus a low- or very-low-traffic area. We computed odds ratios (ORs) indicating the extent to which facility and area explanatory variables influenced the likelihood of a facility being located in a medium- or high-traffic area.

TABLE 1—Capacities of Licensed Child Care Centers, by Facility Type and Size: California, 2000

	Very-Low-Traffic Area, No. (%)	Low-Traffic Area, No. (%)	Medium-Traffic Area, No. (%)	High-Traffic Area, No. (%)
Total facilities	4 551 (19)	13 644 (56)	4 479 (19)	1 534 (6)
Total slots	125 440 (16)	446 103 (56)	171 818 (21)	57 173 (7)
Facility type				
Family child care home	37 349 (25)	81 288 (55)	20 380 (14)	8 438 (6)
Child care center				
Infant care	4 045 (13)	15 547 (49)	9 150 (29)	2 766 (9)
Preschool age	54 134 (11)	266 061 (55)	120 790 (25)	39 123 (8)
School age	29 912 (21)	83 207 (59)	21 498 (15)	6 846 (5)
Facility capacity, no. of slots				
8–12	12 020 (23)	29 343 (55)	8 718 (16)	3 083 (6)
13–20	29 112 (24)	68 967 (56)	18 130 (15)	7 154 (6)
21–50	28 266 (13)	127 014 (59)	44 401 (21)	13 972 (7)
>50	56 042 (14)	220 779 (54)	100 569 (25)	32 964 (8)

Note. Percentages in each row sum to 100. See text for descriptions of traffic area categories.

RESULTS

Although the majority (75%) of licensed child care facilities were situated in low- or very-low-traffic areas, slightly more than 1500 of the facilities studied (6%) were situated in high-traffic areas, and these facilities accounted for approximately 57 200 children when they were filled to capacity (Table 1). Almost 4500 facilities (19%), accounting for up to approximately 171 800 children, were located in medium-traffic areas.

Potential exposure of children to traffic-related pollution varied according to facility type (Table 1). Children in infant care facilities were most likely to receive care in high-traffic areas (9%) and medium-traffic areas (29%), followed by children in preschool facilities (8% and 25%, respectively). In addition, children in facilities with higher capacities were more likely to receive care in medium- or high-traffic areas. Conversely, children in facilities with lower capacities, large family care homes, and facilities providing care to school-aged children were less likely to receive care in medium- and high-traffic areas.

Children in minority area facilities were more likely than children in non–minority area facilities to receive care in medium-traffic areas (Table 2). This pattern was more pronounced in minority areas that were predominantly African American. Children in facilities in poor, foreign-born, limited English, and limited education areas were also more likely to receive care in medium-traffic areas. In addition, children in facilities located in foreign-born areas and limited English areas were slightly more likely than those in facilities located in the other block-group categories to receive care in high-traffic areas.

Children in facilities located in high-density residential areas were more likely to receive care in medium- and high-traffic areas (Table 3). Children in facilities located in areas with more than 25% nonresidential parcels were slightly more likely to receive care in medium- or high-traffic areas, whereas children in facilities located in areas with more than 25% multifamily residential parcels had a substantially higher likelihood of receiving care in medium-traffic areas (39%) and a slightly higher likelihood of receiving care in high-traffic areas (10%).

TABLE 2—Capacities of Licensed Child Care Centers, by Area Racial/Ethnic Composition and Socioeconomic Status: California, 2000

	Very-Low-Traffic Area, No. (%)	Low-Traffic Area, No. (%)	Medium-Traffic Area, No. (%)	High-Traffic Area, No. (%)
Total slots	125 440 (16)	446 103 (56)	171 818 (21)	57 173 (7)
Race/ethnicity classification				
Minority area	51 622 (14)	205 937 (54)	93 230 (25)	29 435 (8)
Black area	2 307 (9)	12 957 (48)	10 085 (37)	1 703 (6)
Latino area	16 676 (11)	86 694 (58)	35 635 (24)	9 543 (6)
Socioeconomic classification				
Poor area<<AU: By what standard?>>	19 491 (11)	103 061 (57)	46 317 (25)	13 528 (7)
Foreign-born area	22 518 (11)	100 965 (51)	58 183 (29)	17 574 (9)
Limited English area	7 821 (10)	43 007 (54)	23 164 (29)	6 188 (8)
Limited education area	22 042 (12)	105 531 (58)	43 292 (24)	11 616 (6)

Note. Percentages in each row sum to 100. See text for descriptions of area traffic classifications and area socioeconomic classifications.

TABLE 3—Capacities of Licensed Child Care Centers, by Nearby Population Density, Highway Proximity, and Type of Nearby Residential Land Use: California, 2000

	Very-Low-Traffic Area, No. (%)	Low-Traffic Area, No. (%)	Medium-Traffic Area, No. (%)	High-Traffic Area, No. (%)
Total slots	125 440 (16)	446 103 (56)	171 818 (21)	57 173 (7)
Tract population density				
Very low (quartile 1)	47 951 (24)	117 602 (60)	19 879 (10)	10 412 (5)
Low (quartile 2)	36 040 (17)	122 059 (58)	38 637 (18)	15 116 (7)
High (quartile 3)	26 658 (13)	109 972 (55)	49 138 (24)	14 804 (7)
Very high (quartile 4)	14 791 (8)	96 470 (50)	64 164 (33)	16 841 (9)
Highway proximity				
Highway within 200 m	. . .	17 679 (20)	24 560 (28)	46 924 (53)
No highway within 200 m	125 440 (18)	428 424 (60)	147 258 (21)	10 249 (1)
Parcel distribution				
> 25% nonresidential	41 587 (15)	147 218 (53)	68 155 (24)	22 237 (8)
> 75% single-family residences	76 450 (18)	245 365 (58)	75 383 (18)	26 842 (6)
> 25% multifamily residences	2 452 (4)	33 156 (47)	27 453 (39)	6 818 (10)

Note. Percentages in each row sum to 100. See text for descriptions of traffic area categories.

The results of the multinomial logistic regression analysis showed that facility-level factors and area-level factors were associated with the odds of a facility being located in a medium-traffic area versus a low- or very-low-traffic area and the odds of a facility being located in a high-traffic area versus a low- or very-low-traffic area. Significance levels should be considered in terms of the large sample size, which enhanced the statistical power of the model. Although this enhanced statistical power could have resulted in some of the correlates being significant even when their differences across groups were relatively small, several of the results obtained are informative.

After control for other factors, facility capacity had a significant but relatively small impact on the odds of a facility being located in a high-traffic area. The odds ratio associated with each 10-slot increase in capacity was 1.03 for both medium- and high-traffic areas (Table 4). Facility type had a large impact on the odds of a facility being located in a medium- or high-traffic area. Family child care homes were less likely than other types of facilities to be located in medium-traffic areas (OR=0.88) and more likely to be located in high-traffic areas (OR=1.13). Infant care centers were much more likely to be located in both medium-traffic (OR=1.40) and high-traffic (OR=1.38) areas. Centers providing care for preschool-aged children were also more likely to be located in medium-traffic (OR=1.13) and high-traffic (OR=1.20) areas.

An increase of 10% in the number of Black residents living in nearby areas was associated with an odds ratio of approximately 1.10 of a child care center being located in a medium- or high-traffic area. Higher percentages of Latino/Hispanic residents living nearby increased the likelihood of a facility being located in a medium- or high-traffic area by a slightly lower magnitude. A 10% increase in the number of foreign-born residents living nearby was associated with approximate odds ratios of 1.20 and 1.30 of facilities being located in medium- and high-traffic areas, respectively.

After control for facility-level and other area-level characteristics, location in a high-density area was a significant predictor of a facility being in a medium-traffic area but was not a significant predictor of a facility being in a high-traffic area. Facilities with high nearby employment densities were more likely to be located in both medium- and high-traffic areas. Higher percentages of nearby multifamily parcels were associated with higher probabilities of child care centers being located in medium-traffic areas.

DISCUSSION

This study suggests that approximately 57 000 of the available slots in California child care centers (7% of the overall capacity) are in facilities located within 200 m (650 ft) of roadways averaging 50 000 or more vehicles per day. Atmospheric science and epidemiological studies consistently suggest that such proximity to this level of traffic is associated with high concentrations of vehicle-related pollutants and a variety of adverse health effects, particularly for young children. Furthermore, almost 172 000 of the state's available child care slots (21% of

TABLE 4—Odds of Child Care Facilities Being Located Within High- or Medium-Traffic Areas vs Low- or Very-Low-Traffic Areas: Multinomial Logistic Regression Results for California, 2000

	Medium-Traffic Area		High-Traffic Area	
	Coefficient	OR (95% CI)	Coefficient	OR (95% CI)
Intercept	−5.556***		−4.802***	
Facility-level variables				
Facility capacity (in 10s)	0.025**	1.03 (1.01, 1.04)	0.032*	1.03 (1.01, 1.05)
Family child care home (1/0)	−0.123**	0.88 (0.83, 0.95)	0.118	1.13 (1.01, 1.25)
Infant care center (1/0)	0.337***	1.40 (1.29, 1.53)	0.320***	1.38 (1.20, 1.58)
Preschool center (1/0)	0.124***	1.13 (1.07, 1.20)	0.182**	1.20 (1.09, 1.32)
Area socioeconomic variables				
Percentage Black	0.014***	1.01 (1.01, 1.02)	0.009***	1.01 (1.01, 1.01)
Percentage Latino/Hispanic	0.005*	1.00 (1.00, 1.01)	0.007*	1.01 (1.00, 1.01)
Percentage foreign born	0.018***	1.02 (1.01, 1.02)	0.026***	1.03 (1.02, 1.03)
Percentage without high-school diploma	−0.021***	0.98 (0.98, 0.98)	−0.027***	0.97 (0.97, 0.98)
Area built environment variables				
Natural log of population density	0.276***	1.32 (1.25, 1.39)	−0.006	0.99 (0.92, 1.07)
Natural log of employment density	0.257***	1.29 (1.25, 1.34)	0.350***	1.42 (1.34, 1.50)
Percentage of single-family parcels	−0.003*	1.00 (1.00, 1.00)	−0.003	1.00 (0.99, 1.00)
Percentage of multifamily parcels	0.011***	1.01 (1.01, 1.01)	0.005	1.00 (1.00, 1.01)

Note. OR = odds ratio; CI = confidence interval. Odds ratios were calculated as the exponents of regression coefficients. See text for descriptions of traffic area categories.
*$P < .01$; **$P < .001$; ***$P < .0001$.

overall capacity) are in facilities located within 200 m of roadways averaging between 25 000 and 49 999 vehicles per day, again with the potential for harmful exposures. These findings may underestimate traffic volumes for facilities with more than 1 heavily traveled roadway nearby.

Our results indicate that a sizeable number of toddlers and young children attend child care centers in close proximity to major roadways, suggesting that they may be exposed to high levels of vehicle-related pollutants. Although children spend only a portion of their day in child care or preschool, the hours they spend in these facilities could represent a significant proportion of their overall daily exposure to air pollution, especially if they are playing outdoors within 200 m downwind of busy roadways. Our findings stress the importance of further study of this microenvironment.

In addition, the time children spend in child care may overlap with diurnal traffic peaks, particularly morning traffic peaks. Given that their rate of breathing is higher than that of older children or adults, young children inhale a greater volume of pollutants relative to their body mass. Young children could also be exposed to high concentrations of vehicle-related pollutants indoors depending on a facility's air exchange rate, surface to volume ratios, use of windows for ventilation, and use of air conditioning.

Location of child care facilities within the urban structure[29] is driven in part by relationships between market forces and constraints, land use patterns, and the transportation infrastructure. For example, centers providing care for preschool- and school-aged children, which tend to have higher capacities and require larger facilities, may tend to locate in mixed land use areas with larger parcels, and thus, they are in closer proximity to major roadways. Accessibility and convenience may also help explain our finding that infant care centers were more often located in medium- and high-traffic areas.

Among other factors, child care center distribution patterns reflect persistent inequalities resulting from uneven land use development, racial and housing segregation, and concentrated poverty. We found that facilities in minority and low-income areas were more likely than facilities in areas that were more affluent and had fewer minority residents to be located in close proximity to busy roads, a pattern consistent with research suggesting that such areas bear a disproportionate burden from air pollution and other environmental hazards.[41–51]

Because significantly fewer child care and early education facilities are located in these areas than in more affluent areas, the First 5 program, whose goal is to provide preschool access to every 4-year-old child in Los Angeles, has targeted the expansion, renovation, and rehabilitation of existing facilities in underserved areas so that all communities can benefit.[52] Programs should carefully consider near-roadway air pollution concerns in evaluations of facility location and expansion criteria to ensure that preschool children residing in the most disadvantaged neighborhoods are not systematically subjected to higher concentrations of vehicle-related pollutants.

Further research is needed to better understand the extent to which our findings can be generalized to other states, especially given that land use patterns, spatial inequalities, and child care siting constraints and licensing procedures vary by region. Given the pervasiveness and economic importance of roadways, however, multiple strategies will probably be necessary to address the adverse effects of vehicle-related pollution on young children on a nationwide scale. Such efforts should adopt a framework that draws from both public health and urban planning to broadly understand the health implications of the transportation infrastructure.[53–63]

Strategies in California could inform responses in other states. Evidence of the high concentration of harmful air pollutants near roadways prompted the California legislature to prohibit public schools within 150 m (500 ft) of busy corridors to protect children's health.[64] Further pollution and exposure monitoring at child care facilities could reveal whether this legislation should be expanded to prohibit the siting of child care facilities within 200 m of major roadways, which more closely corresponds to the distance from major roadways at which vehicle-related air pollutants drop to "background" concentration levels.[5,6,37] The California Air Resources Board recently responded to growing concern over near-roadway pollution by recommending that new "sensitive land uses" such as residences, schools, day care centers, playgrounds, and medical facilities not be sited within 150 m of heavily traveled roadways.[65]

Even if such recommendations are fully implemented, it is highly unlikely that large-scale facility resiting will take place in the immediate future given current market and siting constraints. Additional mitigation approaches may include installing and properly using air filtration systems to limit the intrusion of outdoor air, locating playgrounds and other sites of outdoor activities as far from busy roadways as possible, and restricting rigorous outdoor activities during high traffic periods. Child care and preschool facilities near major roadways should be required to notify parents and guardians of the potential health risks of concentrated vehicle-related pollutants or other nearby air pollutants before children are enrolled. This could alert parents of vulnerable children, such as those with chronic respiratory conditions, of potential risks. ■

About the Authors

Douglas Houston is a doctoral student in the Department of Urban Planning, University of California, Los Angeles. Paul Ong is with the Ralph and Goldy Lewis Center for Regional Policy Studies and the School of Public Affairs, University of California, Los Angeles. Jun Wu and Arthur Winer are with the Department of Environmental Health Sciences, School of Public Health, University of California, Los Angeles.

Requests for reprints should be sent to Douglas Houston, MA, Ralph and Goldy Lewis Center for Regional Policy Studies, School of Public Affairs, University of California, 3250 Public Policy Bldg, Los Angeles, CA 90095-1656 (e-mail: dhouston@ucla.edu).

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Contributors

D. Houston was primarily responsible for the research and writing of the article. All of the authors contributed to the foundation and conceptualization of the study, to interpretation of findings, and to revisions of the article.

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