ON USE OF INJURY DATA

DOUG BRUGGE, PHD MS ■ ANDREW LEONG ■ ZENOBIA LAI

Can a Community Inject Public Health Values into Transportation Questions?

Dr. Brugge is an Assistant Professor, Department of Family Medicine and Community Health, Tufts University School of Medicine, Boston. Mr. Leong is an Assistant Professor, University of Massachusetts at Boston, and Chair of the Campaign to Protect Chinatown. Ms. Lai is a Senior Attorney/Program Director, Greater Boston Legal Services, and Legal Counsel to the Campaign to Protect Chinatown.

Address correspondence to Dr. Brugge, Dept. of Family Medicine and Community Health, Tufts Univ. School of Medicine, 136 Harrison Ave., Boston MA 02111; tel. 617-636-0326; fax 617-636-4017; e-mail <dbrugge@aol.com>.

FOR A RESIDENTIAL COMMUNITY, BOSTON'S CHINATOWN HAS AN EXTRAordinarily large amount of vehicular traffic. Congested streets are packed with traffic day and night, seven days a week. In what follows, we describe how a community-university collaboration brought public health and safety into the local transportation policy-making process by supplementing traditional "level of service" and vehicle volume analyses with injury data.

BOSTON'S CHINATOWN

Chinatown is a highly concentrated and congested community located in downtown Boston. With urban renewal in the 1950s, Chinatown lost many housing units and much useable land to two major interstate highway projects. Additional housing and land was lost with the expansion of two sister institutions, New England Medical Center (NEMC) and Tufts University.[1] These losses coupled with increased immigration from Asia following the lifting of legal restrictions in the 1960s have created conditions that make Chinatown the most crowded neighborhood in the city. Chinatown has the least open space, with more than 9000 residents per acre of open space in 1990; the highest population density (111 residents per acre in 1990), and the lowest housing vacancy rate (1431 units of housing for a population of 5000 in 1990) in Boston.[1] Both foot and vehicular traffic congestion increased when the city government zoned the municipal red light district to the edge of Chinatown in 1974. In addition, the theater district, located next to Chinatown, draws heavy Friday and Saturday evening traffic.

Due to its proximity to commercial downtown, Chinatown is a prime target for development. In 1993, members of the Chinatown community formed the Coalition to Protect Chinatown (CPC) to contest a land and money swap allowing the construction of a NEMC garage.[2]

Community groups are often intimidated by the sheer volume and complexity of the environmental impact studies done by developers. Low-income communities, especially those like Chinatown with large numbers of non-English speaking residents, are particularly ill-equipped to decipher such studies.

Collaboration between communities and independent experts is often needed because of the vast resources developers bring to the decision-making process. Such cooperative efforts have emerged across the country with the growth of the "environmental justice movement." Through these collaborations, communities receive scientific, technical, or legal assistance to challenge companies, government agencies, and others on a more level playing field.

CPC realized that it would be advantageous to bring facts and figures of its own to the debate over the garage. Initially, this took the form of having Chinatown youths count cars at intersections and compare their counts with those put forward by the developer. Later, a collaboration developed between CPC (represented by authors ZL and AL) and a Tufts University School of Medicine researcher (author DB), which represented an effort to "professionalize" the research and technical capacity of the community group. The parties worked together to address issues related to plans for two freeway ramps (both eventually cancelled) and a skyscraper (now being built) in Chinatown. During this work, it became apparent that traffic safety, despite frequent complaints by residents, was not adequately addressed by the developers. The collaborators decided to investigate the traffic issue further, resulting in an analysis of traffic injury patterns in Chinatown.

We believe that our experience in injecting public health considerations into the debate over development has useful implications for other communities.

ENVIRONMENTAL IMPACT REVIEWS

The Massachusetts Environmental Policy Act (MEPA) sets the context within which local transportation decisions are made. The Act mandates that state and local government agencies review, evaluate, and determine the impact on the natural environment of any project involving state funding or land transfers and that they use all practical means to minimize damage to the environment. While the MEPA review process does not prevent a project from going forward, a determination that an Environmental Impact Review is required can delay the start of a project, and such delays often give community groups greater leverage to wring concessions from the developer.[3]

With respect to traffic, a project triggers the MEPA review process if it will generate significant additional daily car trips, add 300 or more parking spaces, or involves the construction or significant widening of existing roadways, interchanges, and mass transit facilities.[4] Transportation analysis in a MEPA review has traditionally used "level of service" (LOS) at intersections, measured by the increased delay that motorists would be expected to encounter, to project the effects of the proposed project. Idling vehicles increase air pollution and degradation of the natural environment.[4] Within the statutory scheme of MEPA, traffic injuries and fatalities, rarely introduced into the analysis, remain secondary to concerns for the natural environment.

RISK FACTORS FOR MOTOR VEHICLE INJURIES

In reviewing the literature on traffic safety, we found that well-defined factors can be related to the risk of injury for both vehicle occupants and pedestrians. Thus, given adequate information, transportation policy could incorporate prevention strategies for most traffic-related injuries.

Motor vehicles are the leading cause of acute injury in the United States, accounting for 29% of all injury deaths in 1995.[5] The US has the second highest motor vehicle fatality rate of all developed countries.[5] The risk of death is highest for the young, for Native Americans, and for the poor.[5,6]

A few analyses of the temporal and geographic distribution of traffic fatalities have been reported.[7,8] However, nonfatal injuries have been studied in less detail. According to a report by the Environmental Working Group, there were over 100,000 pedestrians injured per year in 1991–1995 (roughly 47,500 of whom were injured severely).[9] Risk factors for pedestrians include age (both the young and the elderly are at increased risk[10]); night and other poor lighting conditions[8,10-12]; dark clothing[12]; winter[10]; proximity to downtown of a major city[13]; crowded housing[14]; weekends[11]; elevated blood alcohol of both pedestrian[15] and driver[7]; lower socioeconomic status[8,14,16]; and busier streets and streets with higher speed limits.[16] Not surprisingly, urban locations account for most pedestrian deaths.[17] Interestingly, one study reported that pedestrian crossing devises failed to reduce risk for children.[16] The time allotted by traffic signals for crossing certain intersections has been shown to be inadequate for the walking speed of most elderly people.[18,19] Studies have also shown that younger children tend to be struck more often in driveways and parking lots while older children are more likely to be hit by street traffic.[20,21]

TRAFFIC INJURY DATA

Local police departments have traditionally been responsible for documenting motor vehicle–related injuries and deaths. Through the early 1970s, the city of Boston summarized traffic safety data in a public document, the *Annual Report of the Boston Traffic Commission*. According to Steve Kaiser, an independent traffic engineer, by the mid-1970s the report was replaced by one largely devoted to public relations.

The 1950 annual report[22] remains an excellent model for traffic injury summaries. It documents that 77 people were killed in or by motor vehicles in the city, including 58 pedestrians. Thirty-seven of the fatalities occurred during nighttime hours. Each fatality is described in terms of age and sex of the decedent, hour of the day, day of the week, and month of the year. The offending vehicles included 41 cars, 16 trucks, and one motorcycle, 30 of which were registered outside of Boston. Half of the pedestrian deaths occurred at intersections and half mid-block. No fatalities occurred in Chinatown that year.

This form of reporting was useful because it drew attention to "trouble spots" and helped drive a reduction in motor vehicle–related fatalities in Boston from the 1950s to the 1990s. Essentially the same data are tabulated today, but they are no longer released to the public. Indeed, gaining access to these databases required dogged effort.

Three kinds of data are generally available for use in traffic safety studies: traffic fatality records; traffic injury records; and total collisions involving motor vehicles. We selected injury data for our analyses because of the small number of fatalities in a community the size of Chinatown. We did not look at traffic accidents that did not involve injuries because, while numerous, they do not have clear public health impact.

We obtained 1996 traffic-related injury data for Chinatown from the Boston Police Department's Office of Research Analysis in the form of two overlapping datasets: (*a*) records of traffic reports involving injuries filed by responding police officers and (*b*) records of 911 calls. To make these data available, the Department had to search their full database because these items had not been processed or analyzed. We made repeated requests for the data in writing and by phone before receiving them. Each dataset contained information on street location, time of day, date, and day of the week without the names of the involved parties. We cross-referenced the reports in the two databases, identifying incidents by location and time. We classified the injured as "motor vehicle occupants" and "pedestrians," further subdividing pedestrians into those with "confirmed" and "unconfirmed" injuries. Unconfirmed injuries were those reported in 911 calls that could not be verified in police reports.

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Campaigning for the Chinatown, Boston, community referendum on the New England Medical Center garage proposal.

We plotted the injury report data on a street map of the community using MapInfo[R] software. We stratified injuries by month, day of the week, and time of day for vehicle occupants and pedestrians. The goal was to identify patterns in injury occurrence that would suggest peak times and locations and thus identify risks. We hoped that these patterns would prove to be more revealing than LOS and traffic counts.

RESULTS OF THE INJURY ANALYSES

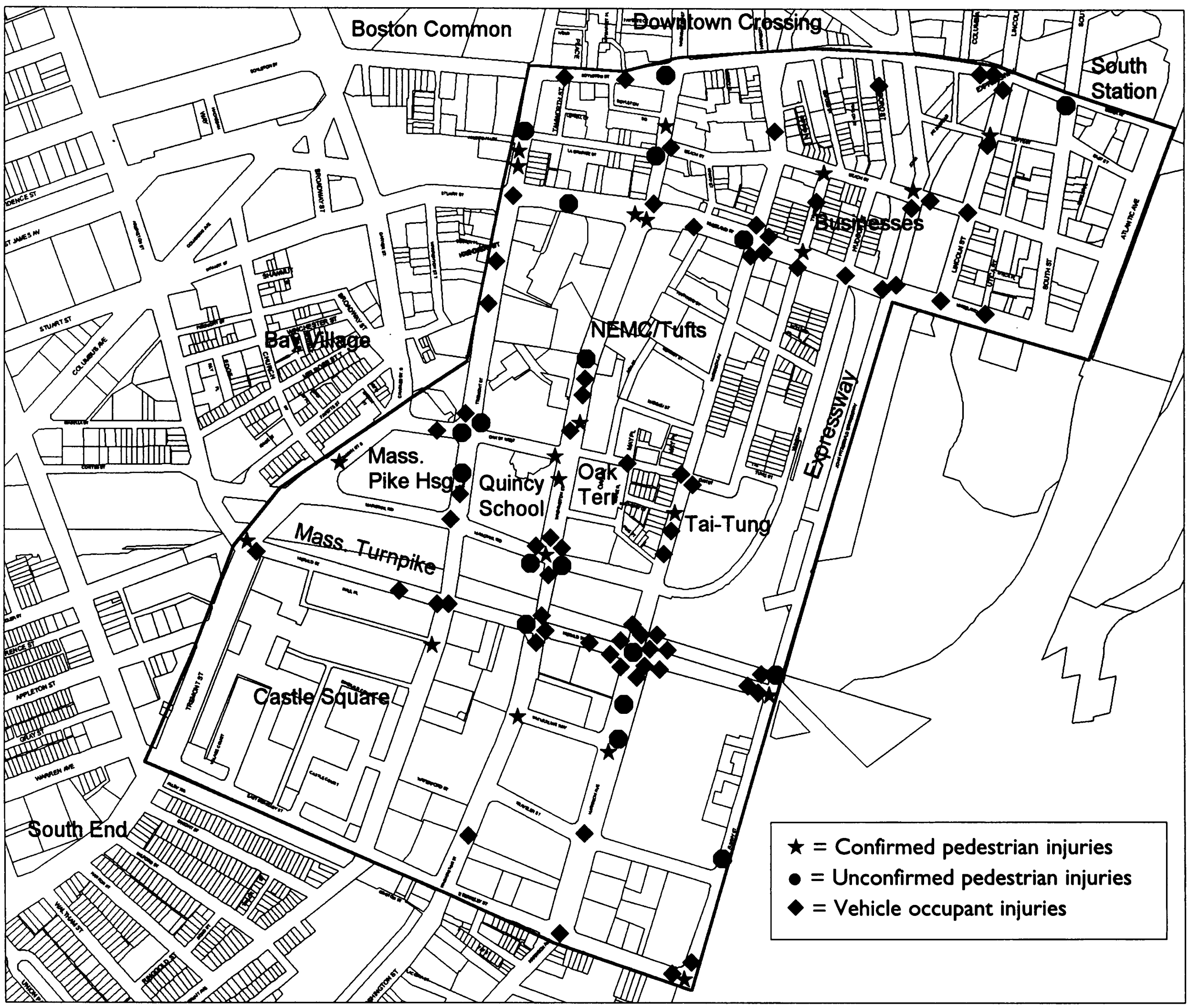
Figure 1, which displays the traffic injuries by location, shows that injuries did not occur evenly throughout the community. Seventy-nine reports (72%) were for incidents along the four major roads through Chinatown. More than 70% of injuries occurred at intersections. Three adjacent intersections along the Massachusetts Turnpike were found to account for 21% of all injury reports while most intersections had fewer than three injury reports. Injury reports were higher near the elementary school and housing areas (including elderly housing developments) just north of the Turnpike than for housing areas south of the highway.

The number of injuries at particular intersections does not appear to be solely a function of traffic volume. Some high-volume intersections had few injuries, while other high-volume intersections had many. Some moderate-volume intersections had clusters of injuries. We calculated a crude estimate of the correlation between traffic volume and injuries at intersections using traffic volume figures from a 1994 NEMC report.[23] The result was a positive correlation, with an r^2 of 0.23, suggesting that less than one-quarter of the variation in injuries was explained by traffic volume.

Vehicle occupant and pedestrian injuries were lower for January through April than for other months. The number of reports per day for both vehicle occupant and pedestrian injuries did not differ between weekends and work days. In fact, pedestrian injuries were higher on Fridays, Saturdays, Sundays, and Mondays than for other days.

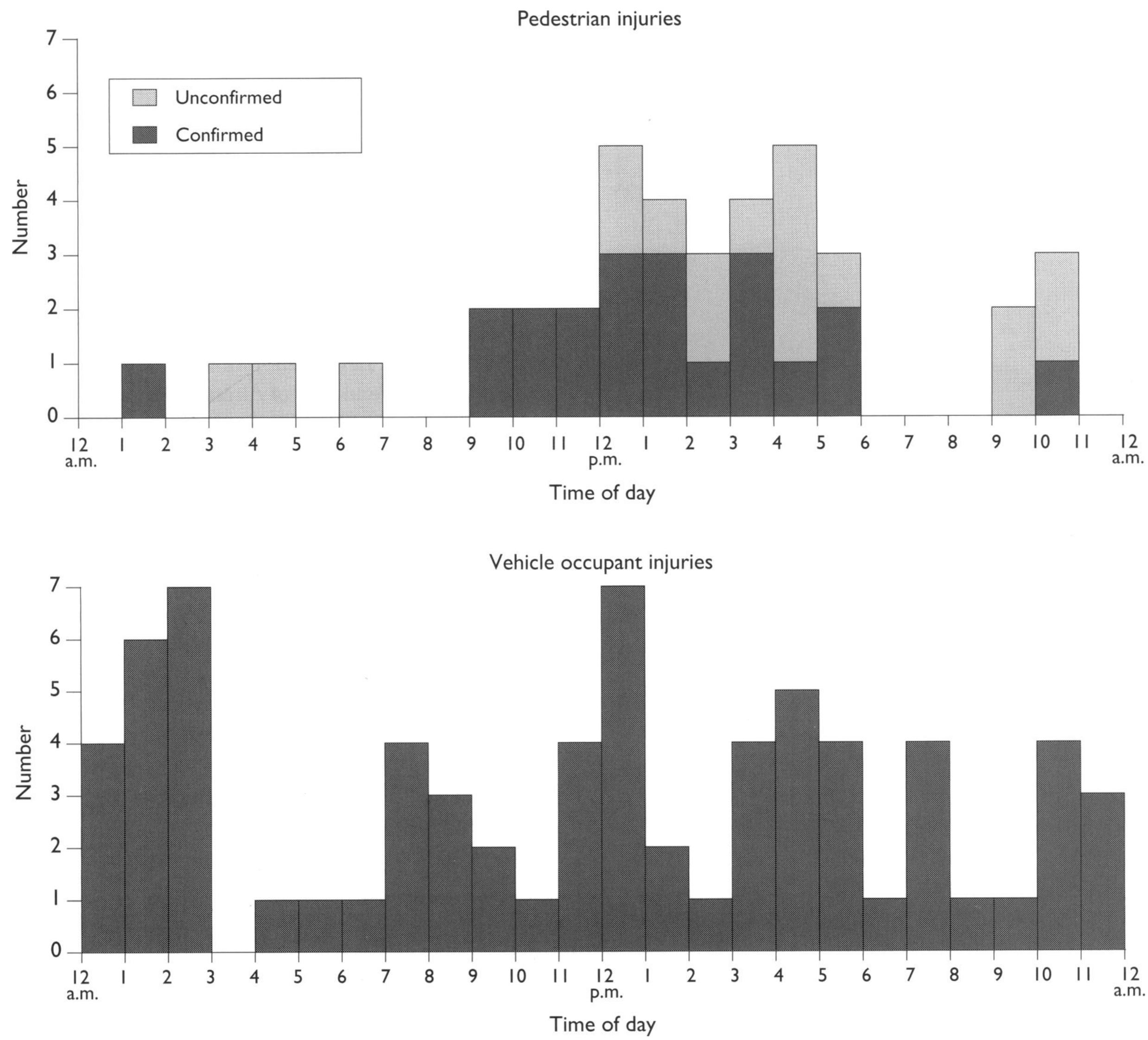
Figure 2, which depicts injuries by time of the day, shows the most striking temporal patterns. Vehicle occupant injuries peaked at times corresponding roughly to commonly defined commuter "rush hours" (7 a.m. to 9 a.m. and 4 p.m. to 6 p.m.), at the lunch hour (11 a.m. to 1 p.m.), and late at night (10 p.m. to 3 a.m.). In contrast, pedestrian injury reports were spread broadly throughout

Figure 1. Reported total traffic injuries, Chinatown, Boston, 1996



This map shows the geographic distribution of reported traffic-related injuries within the study boundary (dark line) for 1996.

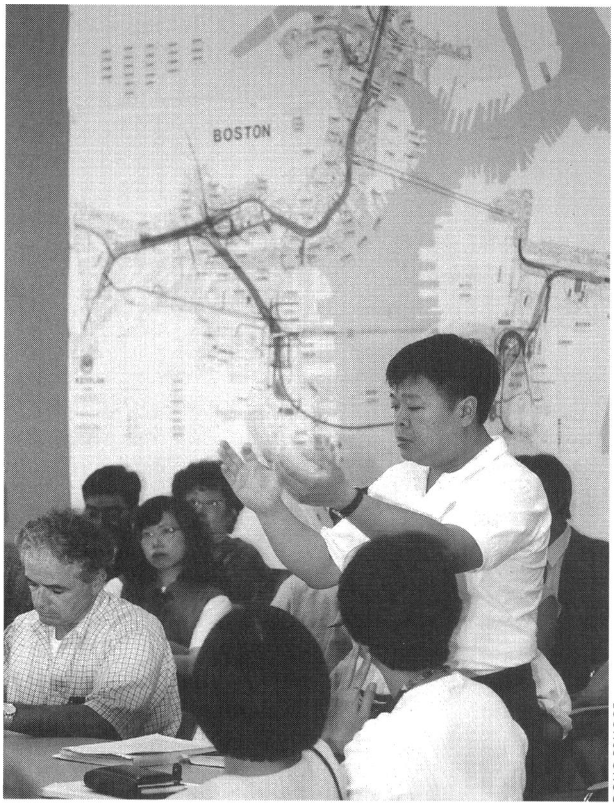
Figure 2. Traffic injury reports by time of day, Chinatown, Boston, 1996



daytime hours (9 a.m. to 6 p.m.). Daytime vehicle occupant injuries occurred primarily on weekdays, while late night injuries were more likely to happen on weekend nights (from 10 p.m. to 3 a.m.).

These analyses suggest that valuable public safety information is lost when traffic impact is characterized only by vehicle volume and LOS, which is typically assessed only for "peak" commuter times. We identified potential safety risks at times of the day and at locations that did not emerge as areas of concern from earlier traffic analyses of Chinatown that were based on vehicle volume.[23-25] Traffic volume is, at best, an indirect measure related to public safety in ways that are poorly understood.

Community members have noted over the years that late night and weekend traffic in Chinatown is frequently as bad as or worse than commuter traffic. Late-night drug buyers, prostitutes and their clients, theatergoers, week-



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Wilson Lee, Chinatown business owner, speaks at a meeting about the Central Artery construction.

end shoppers, and restaurant patrons generate this traffic. Nevertheless, developers repeatedly presented traffic impact analyses that looked only at commuter "rush hour" conditions and reported that their developments would minimally alter LOS at those times. One analysis even concluded that new traffic generated by the development would be distributed into "off-hours" and was, therefore, a benefit.[25] When our analysis reported that peak public safety problems existed at times other than recognized "rush hours," it helped shift the policy debate and documented the assertions long voiced by Chinatown residents.

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In 1997 and 1998 we reported our findings in comments to MEPA, by direct communication with the Boston Transportation Department, and in a written report. In response to the results and to ongoing community pressure, the city of Boston has hired a consultant to conduct a special traffic planning process for Chinatown. Unlike others before it, the process now incorporates late night and weekend traffic patterns. Indeed, the city's consultant, David Black of TAMS Consulting, told us in June 1998 that his firm had found that peak traffic volumes for some streets occurred between 1 a.m. and 3 a.m., corresponding to the late night peak of injuries that we reported. Strikingly, a community-initiated process changed what the city deemed relevant traffic questions after dozens of reports by consultants employing scores of professional traffic engineers had failed to do so.

Our findings have also found an audience at the grassroots level. Penn Loh of Alternatives for Community and Environment told us that his group has conducted its own traffic-related injury analysis based on our approach and produced an injury map and charts of the temporal distribution of traffic injuries.

The geographical distribution of injuries has been particularly useful in identifying specific intersections that require further investigation. A Boston University public health student conducted observational research at three intersections in Chinatown, chosen based on our analysis.[26] Two one-hour observations at each intersection produced a long list of factors at play, including repeated violations of traffic laws by drivers; failure to use pedestrian walk buttons; and unmarked driving lanes and pedestrian crossings.

Some of these factors, which may influence the way vehicle volume is reflected in injuries, are more easily altered than vehicle volumes. The key factors, in addition to traffic volume, that play a role in urban traffic safety include: (*a*) enforcement and observance of traffic laws (such as prohibitions against running red lights, making U-turns, and speeding); (*b*) design of intersections and roadways; (*c*) signals and signage; (*d*) pedestrian and motorist education and behavior change; (*e*) lighting; and (*f*) speed limits. A well-rounded traffic safety plan should address all of these. LOS analyses miss most of them.

A successful prevention program might include: (*a*) increasing the time allotted for pedestrian crossing; (*b*) restricting certain blocks or streets to foot traffic; (*c*) producing and distributing educational and motivational materials; (*d*) reducing speed limits (especially near vulnerable populations such as the elderly and children); (*e*) improving the enforcement of traffic laws and regulations; and (*f*) designing roadways and intersections with an eye toward safety. We also support improvements in public transportation, limits on development projects that increase traffic volume, and creation of new driving routes that bypass crowded neighborhoods. By targeting these interventions to specific locations and times, we may be able to maximize reductions in risk with limited resources. The time is ripe to move from measuring traffic impact as an inconvenience to drivers to more public health–oriented measures such as injury analysis. It will be important to test whether focusing on safety can, in fact, take a bigger bite out of the toll of injuries and deaths that vehicles cause every year.

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