Lowering the speed limit from 30 to 25 mph in Boston: effects on vehicle speeds

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ABSTRACT

Introduction: Effective January 9, 2017, the default speed limit on City of Boston streets was reduced from 30 mph to 25 mph. This study evaluated the effects of the speed limit reduction on speeds in Boston.

Method: Vehicle speeds were collected at sites in Boston where the speed limit was lowered, and at control sites in Providence, Rhode Island, where the speed limit remained unchanged, before and after the speed limit change in Boston. A log-linear regression model estimated the change in vehicle speeds associated with the speed limit reduction. Separate logistic regression models estimated changes in the odds of vehicles exceeding 25 mph, 30 mph, and 35 mph associated with the lower speed limit.

Results: The speed limit reduction was associated with a 0.3% reduction in mean speeds (p=0.065), and reductions of 2.9%, 8.5%, and 29.3% in the odds of vehicles exceeding 25 mph, 30 mph, and 35 mph, respectively. All these reductions were statistically significant.

Conclusions: Lowering the speed limit in urban areas is an effective countermeasure to reduce speeds and improve safety for all road users.

Practical applications: Local communities should consider lowering speed limits to improve road safety. The current practice of setting speed limits according to the 85th percentile free-flow speeds, without consideration of other characteristics of the roadway, can be a hurdle for local communities looking to lower speed limits. Updated state laws that allow municipalities to set lower speed limits on urban streets without requiring laborious and costly engineering studies can provide flexibility to municipalities to set speed limits that are safe for all road users.

Keywords: speed limit reduction, urban areas, speeds

INTRODUCTION

High travel speeds increase the risk of crashing and the risk of injuries when a crash occurs (Bowie & Walz, 1994; Elvik, 2005; Joksch, 1993). Speeding, defined on police crash reports as exceeding the posted speed limit, driving too fast for conditions, or racing, has been a factor in more than a quarter of crash deaths for more than 30 years in the U.S. In 2016, speed was a contributing factor in 9% of property-damage-only crashes, 12% of crashes involving injuries, and 27% of fatal crashes—or a total of 10,111 crash deaths (Insurance Institute for Highway Safety, 2018). The National Highway Traffic Safety Administration estimates that the economic cost of speed-related crashes is about $52 billion each year (Blincoe, Miller, Zaloshnja, & Lawrence, 2015).

It might be assumed that speeding is primarily a problem on higher speed roads, but speeding impacts roadways of all types. The percentage of crash deaths in 2016 that were speeding-related was higher on roads with speed limits of 35 mph or less than on roads with higher speed limits (33% vs. 26%). In densely populated urban areas where speed limits are set on the lower end, motor vehicles often share roads with other road users such as pedestrians. Since pedestrians do not have a vehicle's structure to protect them, small increases in vehicle speeds have an especially large impact on the risk of a serious injury or fatality to a pedestrian involved in a crash (Tefft, 2013). In the United States, pedestrian deaths overall rose by 46% from 2009, the lowest point, to 2016, and increased at a higher rate in urban areas (54%) (Hu & Cicchino, 2018). Over 70% of pedestrian deaths occurred in urban areas during 2009–16.

Lowering speed limits is a strategy that has been used to manage speeds in Canada, Europe, and Australia. Research of lowering speed limits in urban areas to 50 km/h (31 mph) in Australia, to 40 km/h (25 mph) in Canada, and to 32 km/h (20 mph) in the United Kingdom has found reductions in speeds and crashes, especially crashes with severe and fatal injuries, associated with lowered speed limits (Heydari, Miranda-Moreno, & Fu, 2014; Islam, El-Basyouny, & Ibrahim, 2014; Islam & El-Basyouny, 2015; Kloeden & Woolley,2012; Pilkington, Bornioli, Bray, & Bird, 2018). In the United States, although there has been a trend towards raising speed limits on interstates and freeways, which has been found to increase speeds and fatality rates (Farmer, 2017; Hu, 2017; Retting & Cheung, 2008), some cities concerned about recent increases in pedestrian deaths have initiated efforts to improve safety for all road users. As part of these efforts, cities such as Boston, New York City, and Seattle have lowered their default speed limits recently.

In 2016, the Massachusetts legislature amended state law to allow cities and towns to lower speed limits from 30 mph to 25 mph on municipal roads inside densely settled areas or business districts. If it is in the interest of public safety, local government bodies may vote to establish the lower limit without conducting engineering studies or seeking further authority from the state. Effective January 9, 2017, the default speed limit on City of Boston streets was reduced from 30 mph to 25 mph in places without a posted speed limit sign. The 25 mph signs were posted at gateways into the city or onto city-owned streets, as well as at locations where there were speed feedback signs. To publicize the speed limit change, the city issued a press release on the lower speed limit, which was covered by several news outlets. Additional publicity within the first year of the speed limit reduction included, for example, advertisements on buses and subway trains, messages on variable message boards around the city, tweets by the Boston Transportation Department (@BostonBTD on Twitter), notices in offices of the Registry of Motor Vehicles, and so on.

The objective of the current study was to evaluate the effects of lowering the speed limit on speeds and speeding behaviors in Boston.

METHOD

Vehicle speeds were collected at sites in Boston where the speed limit was lowered, as well as at control sites in Providence, Rhode Island, where the speed limit remained unchanged, both before and after the speed limit change in Boston.

Study sites

A total of 50 data collection sites in Boston, where the speed limit was reduced from 30 mph to 25 mph, were selected. Another 50 control sites in Providence, where the speed limit remained 25 mph during the before and after study periods, were included to control for factors other than the speed limit change that might have affected vehicle speeds, such as seasonality. At the time of the study design, it was unknown whether other cities in Massachusetts would lower speed limits later. As a result, control sites were selected outside of Massachusetts. Providence was selected due to its proximity to Massachusetts among major cities outside the state.

The sites in both Boston and Providence included arterials, collectors, and local roads. To minimize the effects of roadway characteristics on vehicle speeds, all the sites were similar in that they had no more than one lane per direction, and were located away from intersections on relatively flat, straight roadway segments. There was no posted speed limit sign at any of the sites. In addition, all the sites were located at least half a mile away from any school or speed feedback sign. The school zone speed limit in both Boston and Providence was 20 mph for the entirety of the study period.

Speed data collection

Vehicle speeds were measured by using road tube counters placed perpendicular to traffic flow along the road pavement. The before speed data were collected during October–December 2016 except at two sites, where data were collected in January 2017 before the 25 mph speed limit took effect. The after data were collected at the same sites during September–November 2017, 8–10 months after Boston's speed limit change. At each site during both the before and after data collection periods, speeds of individual vehicles were collected in 5-hour blocks during off-peak daytime hours (10 a.m.–3 p.m.) on two weekdays under dry weather conditions. Traffic volumes were calculated based on the recorded numbers of passing vehicles during each data collection period at each site.

Analysis

To evaluate changes in vehicle speeds associated with the speed limit reduction, a log-linear regression model was estimated, with the natural logarithm of speeds as the dependent variable. Additionally, to evaluate changes in the odds of vehicles exceeding 25 mph, 30 mph, and 35 mph associated with the lower speed limit, separate logistic regression models were estimated. In these models, the dependent variables were binary speed indicators (higher than 25 mph, higher than 30 mph, and higher than 35 mph, respectively).

In both the log-linear regression model and the logistic regression models, the dependent variables included hourly vehicle counts per lane, a study period indicator (after vs. before speed limit reduction), a site group indicator (Boston vs. Providence), and an interaction term between the study period and site group indicators. The interaction variable tested whether the changes in speeds or odds of speeds higher than 25 mph, 30 mph, or 35 mph from the before to after period differed between the study and control sites. The differences were interpreted as the changes in mean speeds or odds beyond what would have been expected absent the speed limit reduction. For example, if the estimated parameter for the interaction is -0.0027 in the log-linear model, the percentage change in average vehicle speeds is calculated as ([exp(-0.0027)-1]*100), a 0.3% reduction compared with the average speed that would have been expected without the speed limit change. If the estimated parameter for the interaction is -0.0294 in the logistic regression model of speeds higher than 25 mph, the percentage change in the odds of vehicles exceeding 25 mph is calculated as ([exp(-0.0294)-1]*100), a 2.9% reduction compared with the odds had there been no speed limit reduction.

Variables with *p* values less than 0.05 were considered statistically significant.

RESULTS

The hourly vehicle count per lane at sites in Boston was 262 vehicles on average with a maximum of 607 vehicles during the before period, and 257 vehicles on average with a maximum of 551 vehicles during the after period. At control sites in Providence, the hourly vehicle count per lane was 229 vehicles on average with a maximum of 503 vehicles during the before period, and 238 vehicles on average with a maximum of 508 vehicles during the after period.

Table 1 summarizes the mean speeds; 85th percentile speeds; proportions of vehicles exceeding 25 mph, 30 mph, and 35 mph; and percentage changes from the before to after period by study group and study period. From the before to after period, the mean speeds remained unchanged at sites in Boston and slightly increased at control sites in Providence. The 85th percentile speeds did not change at both Boston and Providence sites. Proportions of vehicles exceeding 25 mph, 30 mph, and 35 mph all declined at sites in Boston, with the largest reduction in proportions of vehicles exceeding 35 mph. The proportions all increased at control sites.

Table 1. Mean speeds; 85th percentile speeds; and proportions of vehicles exceeding 25 mph, 30 mph, and 35 mph by study group and study period

Period	Boston sites					Providence sites				
	Speed (mph)		Proportions			Speed (mph)		Proportions		
	Mean	85th percentile	> 25 mph	> 30 mph	> 35 mph	Mean	85th percentile	> 25 mph	> 30 mph	> 35 mph
Before	24.8	31.0	47.9%	18.2%	4.9%	24.8	31.0	45.9%	15.9%	3.5%
After	24.8	31.0	46.9%	18.1%	3.8%	24.9	31.0	46.2%	17.5%	4.1%
Before-to-after change	0%	0%	−2.1%	−0.5%	−22.4%	0.4%	0%	0.7%	10.1%	17.1%

Mean vehicle speeds

Table 2 provides estimated results of the log-linear regression model. After adjusting for hourly vehicle counts, based on the interaction term between the after vs. before and Boston vs. Providence site indicators, the average vehicle speed at sites where the speed limit was lowered was an estimated 0.3% lower than what would have been expected without the speed limit change, and the difference was not significant (p=0.065).

Table 2. Log-linear regression modeling results of vehicle speeds

Parameter	Estimate	*P* value
Intercept	3.0978	<.0001
Hourly vehicle counts (per ten vehicles)	0.0041	<.0001
After vs. before time-period indicator	0.0019	0.0902
Boston vs. Providence indicator	−0.0118	<.0001
Interaction between after vs. before and Boston vs. Providence indicators[1]	−0.0027	0.0654

[1]: based on this parameter, estimated percentage change in mean speeds associated with lowering speed limit: −0.3%

Odds of vehicles exceeding 25 mph, 30 mph, and 35 mph

Table 3 provides results of the logistic regression models that estimated effects of the lower speed limit on the odds of vehicles exceeding 25 mph, 30 mph, and 35 mph. After accounting for the effects of hourly vehicle counts, based on the estimates of the interaction term between the after vs. before and Boston vs. Providence indicators, the odds of vehicles exceeding 25 mph, 30 mph, and 35 mph were an estimated 2.9% lower, 8.5% lower, and 29.3% lower, respectively, than would have been expected without the speed limit reduction (Table 4). All three differences were statistically significant.

Table 3. Logistic regression modeling results of vehicles exceeding 25 mph, 30 mph, and 35 mph

Parameter	Exceeding 25 mph		Exceeding 30 mph		Exceeding 35 mph	
	Estimate	*P* value	Estimate	*P* value	Estimate	*P* value
Intercept	−0.8110	<.0001	−2.3347	<.0001	−4.1734	<.0001
Hourly vehicle counts (per ten vehicles)	0.0293	<.0001	0.0279	<.0001	0.0343	<.0001
After time-period indicator	−0.0144	0.1282	0.0895	<.0001	0.1173	<.0001
Boston indicator	0.0057	0.5084	0.0822	<.0001	0.2182	<.0001
Interaction between after vs. before and Boston vs. Providence indicators	−0.0294	0.0153	−0.0887	<.0001	−0.3467	<.0001

Table 4. Summary of estimated changes in odds of vehicles exceeding 25 mph, 30 mph, and 35 mph

	Estimated change in odds	*P* value
Exceeding 25 mph	−2.9%	0.0153
Exceeding 30 mph	−8.5%	<.0001
Exceeding 35 mph	−29.3%	<.0001

DISCUSSION

The recent upward trend in crash fatalities, and in pedestrian fatalities in particular, has prompted many cities to initiate efforts to improve safety for all road users, including those who drive, walk, or bike on city streets. In Boston, the default speed limit on city streets was lowered from 30 mph to 25 mph. The current study found that there were significant reductions in the odds of vehicles exceeding 25 mph, 30 mph, and 35 mph associated with the speed limit reduction, and the reduction was the largest for the odds of exceeding 35 mph. This is the first known U.S. study that rigorously evaluated the effects of lowering speed limits on speeds in an urban area.

Although the study did not examine the effects on crashes, current findings suggest that there are safety benefits associated with the lower speed limit. Average and 85th percentile speeds did not change meaningfully, but the reductions in the proportions of vehicles traveling at higher speeds have important implications for nonmotorists. A study of U.S. pedestrian crashes found that the average risk of severe injury to a struck pedestrian increased from 25% at 25 mph to 50% at 33 mph and 75% at 41 mph (Tefft, 2013). Fewer serious and fatal injuries to nonmotorists can be expected if fewer vehicles are traveling at speeds that are excessive for urban roads. The 85th percentile free-flow speed is commonly used to set speed limits in the United States, but 85th percentile speeds in Boston were higher than 25 mph before and after the speed limit was lowered. These results demonstrate that safety benefits can be gained in urban areas from setting speed limits that take into account all road users, instead of setting speed limits based on the 85th percentile free-flow speeds.

The City of Boston installed speed feedback signs together with posted speed limit signs at selected locations, which previous research found to be an effective method for reducing speeds at desired locations (Hallmark, Hawkins, & Smadi, 2015; Santiago-Chaparro , Chitturi, Bill, & Noyce, 2012). However, the study did not evaluate the effects of the speed feedback signs, due to a lack of sites near these signs. Visible enforcement is another effective method of increasing compliance with the speed limit. Automated speed enforcement, which has not been used in Boston, has been shown to substantially reduce speeding and crashes, especially crashes involving severe injuries (Hu & McCartt, 2016; Retting & Farmer, 2003; Retting, Farmer, & McCartt, 2008; Retting, Kyrychenko, & McCartt, 2008; Wilson Willis, Hendrikz, Le Brocque, & Bellamy, 2010). Enforcement levels of the 25 mph speed limit during the study period were unknown, but it is likely that automated enforcement of the reduced speed limit could help achieve better compliance with the law, greater speed reductions, and thus greater road safety improvements in Boston. Other traffic-calming measures, such as speed humps, road diets, raised crosswalks, and roundabouts or mini-roundabouts, can be used to slow drivers down in cities looking to reduce speeds (Federal Highway Administration, 2017), with or without also lowering the speed limit.

There are several limitations of this study. Sites in Providence were not perfect control sites. One difference between the site groups was that the speed limit was 25 mph at sites in Providence and 30 mph in Boston during the before period. However, the difference should have had minimal effect on the study results, since the analyses compared before-to-after changes in speeds between sites in Boston and

Providence, and the speed limit at Providence sites remained the same during both time periods. Boston also is a denser city than Providence, but the difference should not have had much of an effect on the results. Although traffic volumes at Boston sites were generally higher than at Providence sites during the data collection periods, vehicle speeds were collected under free-flow conditions at all the sites. In addition, the analyses controlled for traffic volumes. The study investigated the short-term effects of the speed limit change on speeds. Longer term effects should be examined in the future.

This study shows that lowering the speed limit reduced speeding and thus should improve safety for all road users in Boston. Local communities should consider lowering speed limits as one of the effective countermeasures to improve road safety. The current practice of setting speed limits on the single factor of 85th percentile free-flow speeds can be a hurdle for local communities to lower speed limits for safety. State and local practices should be updated to establish alternative speed limit-setting methods in urban areas that allow engineers and planners to account for other site characteristics such as number of adjacent driveways, intersection spacing, and pedestrian and bicyclist presence. Updated state laws that allow municipalities to set lower speed limits on urban streets without requiring laborious and costly engineering studies could provide important flexibility to municipalities to set speed limits that are safe for all road users.

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