

EVALUATION OF NEW YORK'S SEAT BELT LAW EXPANSION ON REAR-SEAT ADULT RESTRAINT USE IN CRASHES

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Conducted by

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EXECUTIVE SUMMARY

Background and Objective

New York's seat belt law, first implemented on December 1, 1984, was expanded to require universal coverage of all motor vehicle occupants on November 1, 2020. Prior to this date, passengers 16 years of age and older riding in the rear seat were exempt from the state's seat belt law. To determine the effect of the seat belt law expansion on seat belt use compliance, the New York State Governor's Traffic Safety Committee (GTSC) has funded the Institute for Traffic Safety Management and Research (ITSMR) to conduct a study on the effect of the law expansion on the restraint use of rear-seat adult passengers in fatal and personal injury (F&PI) crashes. The objective of the study is to estimate the effect of the law expansion on (1) the overall restraint use of rear-seat adult passengers at the time of the crash and (2) the restraint use of rear-seat passengers with a high risk of crash-related serious injury.

Methods

The seat belt law expansion was enacted during the COVID-19 pandemic, a public health crisis that significantly changed driving patterns and behaviors in New York State. To identify the effect of the seat belt law expansion independent of other time-varying factors, the current study used a controlled interrupted time series design. Changes in restraint use following the law expansion were compared between the rear-seat adult passengers and two control groups: (1) rear-seat passengers under age 16, and (2) front-seat occupants. Using data from the New York State Department of Motor Vehicles Accident Information System (AIS), the analyses were based on occupants in non-parked passenger vehicles in police-reported F&PI crashes from 2018 to 2021.

Findings and Implications

In the period after the law expansion (November 2020 - December 2021), 92% of the rear-seat adult passengers were restrained at the time of the crash, up from 88% in the pre-law period (January 2018 - October 2020). In comparison, the seat belt use rate remained the same at 98% among front-seat occupants and rear-seat passengers under age 16 in F&PI crashes.

The time series analyses indicate that the seat belt law expansion had a gradual impact on restraint use over the post-law period. The law expansion increased the seat belt use rate of rear-seat adult passengers in F&PI crashes by 2 percentage points in the first post-law month and by almost 6 percentage points in the last post-law month.

The law expansion had a positive, if not larger, impact on the restraint use of rear-seat adult passengers traveling at night, with a young driver, and in a speeding vehicle. However, the post-law restraint use of these high-risk rear-seat adult passengers remained lower than the average rear-seat adult passenger. Of particular concern are rear-seat adult passengers in a speeding vehicle; only 79% were restrained at the time of the crash in the post-law period.

The state should continue to publicize the importance of buckling up in the rear seat and strengthen the enforcement of the seat belt law for rear-seat adult passengers. Specific strategies are needed to target rear-seat adult passengers with a high risk of crash-related serious injury and low restraint use.

INTRODUCTION

While early efforts to increase seat belt use focused primarily on the front seat, rear-seat restraint use has gained increasing attention (Chaudhary et al., 2022). Rear-seat restraint use is important to the safety of oneself and others in motor vehicle crashes. NHTSA estimated that the effectiveness of lap-shoulder belts in reducing fatalities among rear-seat passengers is 54%-58% in passenger cars and 75% in light trucks and vans (Kahane, 2017). Studies of fatal crashes have consistently found that unrestrained rear-seat passengers significantly increase the risk of death of restrained rear-seat passengers and front-seat occupants (Bose et al., 2013; Cummings & Rivara, 2004; Mayrose, 2005).

Prior to 2020, passengers aged 16 and older in New York State were not required to wear a seat belt in the rear seat of a motor vehicle. With the expansion of the seat belt law, effective November 1, 2020, New York joined the list of 20 states that have primary enforcement seat belt laws covering adult passengers in all seating positions. A primary enforcement seat belt law allows law enforcement officers to stop vehicles and issue tickets based on the observation of a seat belt violation alone. Unrestrained adult passengers can be punished by a civil fine of up to fifty dollars per person.

To determine the effect of the seat belt law expansion on seat belt use compliance, the New York State Governor's Traffic Safety Committee (GTSC) has funded the Institute for Traffic Safety Management and Research (ITSMR) to conduct a study on the effect of the law expansion on the restraint use of rear-seat adult passengers in fatal and personal injury (F&PI) crashes. Prior evaluation studies of seat belt laws focused primarily on front-seat occupants during the daytime. There is consistent evidence that mandatory seat belt laws significantly increase restraint use, and primary enforcement does so more effectively than secondary enforcement (Chaudhary et al., 2010; Cohen & Einav, 2003; Masten, 2007). Several studies evaluated the effect on restraint use at night, when the risk of a crash is higher (Chaudhary et al., 2010; Masten, 2007). They emphasized that the extent to which the enactment of a seat belt law can translate into reductions in fatalities depends on its effect on those most in need of occupant protection.

Given the prior literature, the current study aimed to answer two research questions:

- (1) What is the effect of the law expansion on the overall restraint use of rear-seat adult passengers in F&PI crashes?
- (2) What is the effect of the law expansion on the restraint use of rear-seat adult passengers with a high risk of crash-related serious injury?

BACKGROUND

On December 1, 1984, New York State implemented the nation's first mandatory seat belt law (VAT 1229-C), which required seat belt use for all front-seat occupants (i.e., drivers and passengers), and rear-seat passengers under age ten. Over the years this law was extended so that as of November 1, 2020, it covers all motor vehicle occupants of any age in any seating position. A brief history of New York's seat belt legislation is as follows:

- **1984:** New York passed the nation’s first mandatory seat belt law. This primary enforcement law covered all front-seat occupants and children under 10 years old riding in the rear seat.
- **2000:** The law was extended to require restraints for rear-seat passengers 15 and younger.
- **2009:** New York’s “Booster Seat Law” required children to be restrained in an appropriate child restraint system, until they reach the age of 8.
- **2017:** Drivers and front seat passengers 16 and older must wear seat belts in taxi and livery vehicles.
- **2019:** Children under the age of 2 must ride in a rear-facing car seat.
- **Effective November 1, 2020:** The coverage of the state’s seat belt law was extended to passengers aged 16 and older in the back seat of a motor vehicle. In a taxi or livery vehicle, backseat passengers 16 and older, and front-seat passengers who are 8-15 years of age must be restrained by a seatbelt.

Since 1984, New York State has conducted periodic statewide observational surveys of seat belt use of front-seat occupants during the daytime. New York’s front seat belt use rate has been 90% or higher each year since 2010 and has been consistently above the national average. Much of New York’s success in maintaining a high compliance rate can be attributed to the continued implementation of the state’s Buckle Up New York/Click It or Ticket (BUNY/CIOT) program, which includes high-visibility enforcement and engagement, zero tolerance enforcement and a vigorous public information and education campaign. Law enforcement agencies are encouraged to focus on low-use areas of the state, high-risk groups, and conducting enforcement at times of the day when compliance is traditionally lower. Public information and education efforts are directed at the general population in the state and specific groups that have been identified as high-risk, low-compliance segments of the population.

Information regarding the new universal seat belt law was disseminated to the public through several different avenues. The new requirement was added to the occupant restraint page on the GTSC website, promoted at public outreach events by the Survivor Advocate Speaker’s Bureau, during public announcements at sporting events hosted by the New York State Public High School Athletic Association, as a component of the Protect Your Melon occupant protection awareness campaign, and through GTSC social media efforts.

METHOD

Research Design

To determine whether an intervention has caused an effect, a comparison needs to be made between the observed outcome post-intervention and an approximation of the counterfactual, that is, what would have happened if the intervention had not taken place. A simple pre-post design compares the outcome from the pre-intervention period to the post-intervention period. Here, the outcome in the pre-intervention period acts as the approximation of the counterfactual. However, such a design does not consider pre-existing trends in the outcome. For example, the adult rear seat belt use rate might have been gradually increasing over time before the seat belt law expansion. As a result of this preexisting trend, even if the law expansion had no effect, there would be a positive change in the adult rear seat belt use rate from the pre-intervention period to the post-intervention period.

Moreover, a simple before-after comparison cannot exclude abrupt changes occurring around the same time as the seat belt law expansion as the cause of any detected change in seat belt use. The seat belt law expansion was enacted during the COVID-19 pandemic, a public health crisis that significantly changed driving patterns and behaviors across the nation. In 2019, around 25% of the New York State population stayed home on any given day (Bureau of Transportation Statistics, 2021). This percentage rose sharply to 35% in April 2020 and peaked again at 35% in the first two months following the expansion of the seat belt law. Changes in travel patterns may differ for those who regularly use safety restraints in the rear seat of a motor vehicle and those who don't. For example, adults who regularly wear a seat belt in the rear seat may be more risk-averse and more likely to reduce travel during the height of the pandemic. For those who remained on the roads, self-report survey data suggests that some drivers engaged in riskier behavior, particularly excessive speeding and impaired driving (Vanlaar et al., 2021). It is hypothesized that the decreased traffic volume produced an environment conducive to speeding (Office of Behavioral Safety Research, 2021; Wagner et al., 2020). Research also found increases in alcohol and other drug use among seriously and fatally injured road users during the pandemic (Thomas et al., 2020). These changes may have an impact on individual decisions to buckle up.

To identify the effect of the seat belt law expansion independent of other time-varying confounders, the current study used a controlled interrupted time series design. The interrupted time-series design ensures that the observed changes in seat belt use rate before versus after the law expansion were not due to the pre-existing trend or other time-varying confounders that were included in the model. To further strengthen causal inferences concerning the relationship between the law expansion and adult rear seat belt use, we examined two control groups: (1) rear-seat passengers under age 16, and (2) front-seat occupants. These two groups of occupants were required to wear seat belts throughout the study period. Therefore, the law expansion should not have any direct effect on the control groups. Crucially, the control groups were exposed to the same changes during the COVID-19 pandemic as the treatment group (i.e., rear-seat passengers aged 16 and over). The observation of an effect in the treatment group but not in the control groups provides strong evidence that the effect is due to the seat belt law expansion. If an effect is detected in both the treatment and the control groups, the effect is due to some confounding factors. The controlled interrupted time series design has been widely used for the evaluation of public health interventions, including cycle helmet laws and front seat-belt laws (Lopez Bernal et al., 2016).

Data & Measures

For this study, we focus on police-reported F&PI crashes from 2018 to 2021, extracted from the New York State Department of Motor Vehicles Accident Information System (AIS). AIS is the state's primary crash information system. It captures a wide variety of data from the crash reports submitted by police agencies and motorists. New York State Vehicle and Traffic Law (VAT 603) requires police officers to investigate and report all F&PI crashes. Therefore, police-reported data on occupant restraint use in F&PI crashes have high validity and reliability over time.

Only occupants in non-parked passenger vehicles (e.g., cars, SUVs, vans, and pickup trucks) were included in the analyses. The percentage of occupants who were restrained was calculated by month for rear-seat passengers aged 16 and over, rear-seat passengers under age 16, and front-seat occupants. Occupants were categorized as "restrained" when using the available restraint system, including seat belt, harness, and child restraint, at the time of the accident. Because the status of restraint use was unknown for some

occupants, the percentage restrained was calculated based on occupants with known restraint use. The sample provided 34 months of pre-intervention data and 14 months of post-intervention data.

The time-series analyses controlled for observed changes in travel patterns, occupant characteristics, and risky behaviors. The control variables include monthly measures of the percentage of occupants who were traveling at night, the percentage of occupants who were male, the percentage of occupants in a vehicle where the driver was under 25, the percentage of occupants in a speeding vehicle, and percentage of occupants in a vehicle with an impaired driver. To measure nighttime travel, we defined the nighttime period as 9:00 PM to 3:59 AM following prior research (Chaudhary et al., 2010; Chaudhary & Preusser, 2006). A speeding vehicle is defined as one where the driver was ticketed for speeding or a contributing factor of unsafe speed was associated with the vehicle. A vehicle with an impaired driver is defined as one where the driver was ticketed for alcohol/drug-impaired driving, or a contributing factor of alcohol/drugs was associated with the vehicle, or the driver had a positive BAC/drug test result.

RESULTS

The current study included 838,657 occupants of passenger vehicles in police-reported F&PI crashes in New York State from 2018 to 2021. Of the 838,657 occupants, 5% were rear-seat passengers aged 16 and over, 7% were rear-seat passengers aged 15 and under, and 88% were front-seat occupants. After excluding occupants with unknown status of restraint use, the final sample included 40,617 rear-seat adult passengers, 52,485 rear-seat passengers aged 15 and under, and 672,616 front-seat occupants.

Descriptions of Restraint Use

Figure 1 presents the monthly percentage of occupants who were restrained at the time of the crash among the treatment group (rear-seat passengers aged 16 and over), and two control groups (rear-seat passengers aged 15 and under, and front-seat occupants). The red vertical line in the figure indicates the month when the coverage of the state's seat belt law was extended to passengers aged 16 and over in the back seat of a motor vehicle. Given that the law expansion did not directly affect the control groups, their trends in restraint use are presented for comparison purposes.

The increase in the percent restrained among rear-seat adult passengers around the time of the law expansion can be seen in the blue line. A small increase in the immediate aftermath of the law change was followed by a larger upward shift in the later months. In comparison, there were no meaningful changes in the percent restrained around the time of the law expansion in the two control groups. Figure 1 also shows a negative COVID effect on restraint use. There was a notable drop in the percent restrained around the statewide lockdown (March to May 2020) among all three groups of occupants. For front-seat occupants, the percent restrained was slightly lower throughout 2021, in comparison to the pre-COVID months.

Figure 1. Percent Restrained by Occupant Group

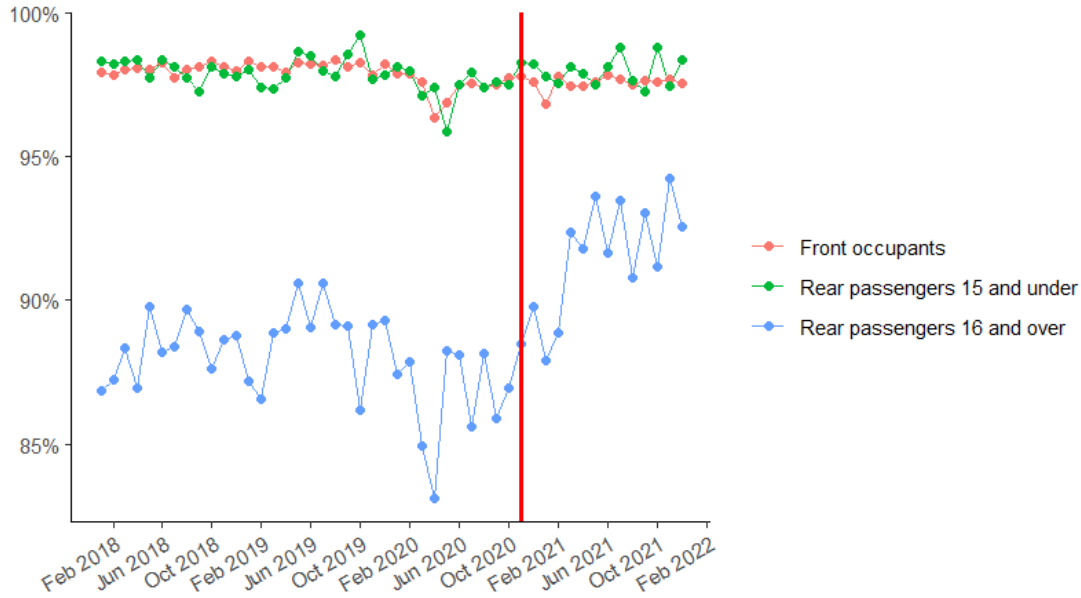


Table 1 summarizes the percent restrained before and after the seat belt law expansion. In the period before the law expansion (January 2018 to October 2020), 88% of the rear-seat adult passengers in F&PI crashes were restrained. During the same period, 98% of the rear-seat passengers aged 15 and under, and 98% of the front-seat occupants in F&PI crashes were restrained. In the period after the law expansion (November 2020 to December 2021), the percentage of rear-seat adult passengers in F&PI crashes who were restrained increased to 92%. The percent restrained stayed roughly the same in the two control groups. The fact that only the treatment group had a notable increase in the percent restrained gives us confidence that the seat belt law expansion, not other concurrent events, contributed to the increase.

Table 1. Percent Restrained of Passenger Vehicle Occupants in Police-Reported F&PI Crashes

	Pre-law (1/2018 – 10/2020)	Post-law (11/2020 – 12/2021)	Percentage Point Change
Rear-seat passengers 16 and over	N=30,171	N=10,446	
<i>% Restrained</i>	88.2%	91.7%	3.4%
Rear-seat passengers 15 and under	N=39,608	N=12,877	
<i>% Restrained</i>	97.9%	98.0%	0.0%
Front seat occupants	N=494,808	N=177,808	
<i>% Restrained</i>	98.0%	97.6%	-0.4%

Prior research found that nighttime drivers, young drivers, and speeding drivers have a higher crash rate per million miles driven and higher crash severity (Aarts & van Schagen, 2006; Haleem & Gan, 2013; Johansson et al., 2009; Preusser, 2003; Ryan et al., 1998). Occupants traveling at night, with young or speeding drivers are therefore most in need of occupant protection. Table 2 summarized the percent restrained before and after the law expansion for these three groups of occupants respectively.

Compared to all rear-seat adult passengers (see Table 1), the percent restrained in the pre-law period was lower for rear-seat adult passengers traveling at night, with a young driver, or in a speeding vehicle. Most notably, only 74% of rear-seat adult passengers in a speeding vehicle in F&PI crashes were restrained in the pre-law period. In the post-law period, the percentage of rear-seat adult passengers who were restrained increased by 3 percentage points for those traveling at night, 4 percentage points for those with a young driver, and 5 percentage points for those in a speeding vehicle. Rear-seat adult passengers in a speeding vehicle had the lowest level of restraint use in the post-law period, with only 79% restrained. For front-seat occupants and rear-seat passengers aged 15 and under, the change in restraint use ranged from -1.5 to 0.5 percentage points. The fact that only those directly targeted by the law expansion had a notable increase in the percent restrained gives us confidence that the seat belt law expansion had a positive impact on the restraint use of these high-risk rear-seat adult passengers.

Table 2. Percent Restrained of High-Risk Passenger Vehicle Occupants in Police-Reported F&PI Crashes

	Pre-law (1/2018 – 10/2020)	Post-law (11/2020 – 12/2021)	Percentage Point Change
Night Driving			
Rear-seat passengers 16 and over	N=6,849	N=2,557	
<i>% Restrained</i>	84.3%	87.1%	2.7%
Rear-seat passengers 15 and under	N=3,349	N=1,284	
<i>% Restrained</i>	95.8%	96.3%	0.5%
Front seat occupants	N=60,620	N=25,085	
<i>% Restrained</i>	95.9%	95.0%	-0.9%
Driver Under 25			
Rear-seat passengers 16 and over	N=8,382	N=3,069	
<i>% Restrained</i>	85.3%	89.2%	3.9%
Rear-seat passengers 15 and under	N=3,805	N=1,461	
<i>% Restrained</i>	95.5%	95.6%	0.0%
Front seat occupants	N=95,598	N=36,656	
<i>% Restrained</i>	97.5%	97.0%	-0.5%
Speeding Driver			
Rear-seat passengers 16 and over	N=2,450	N=1,031	
<i>% Restrained</i>	73.9%	79.0%	5.1%
Rear-seat passengers 15 and under	N=1,815	N=663	
<i>% Restrained</i>	93.0%	92.9%	-0.1%
Front seat occupants	N=31,252	N=12,371	
<i>% Restrained</i>	93.4%	91.9%	-1.5%

Note. For night driving, nighttime refers to 9:00 PM to 3:59 AM.

The Effect of the Seat Belt Law Expansion on Restraint Use

Using interrupted time series analyses, Table 3 presents the estimated effect of the seat belt law expansion on restraint use of rear-seat adult passengers in F&PI crashes, adjusting for pre-intervention trends in restraint use, and observed changes in travel patterns, occupant characteristics, and risky behaviors. Both sudden and gradual impact models were evaluated for fit. The gradual impact model assumes that the intervention had a gradual impact on monthly restraint use, whereas the sudden impact model assumes that the intervention had an immediate and permanent effect. The results suggest that the seat belt law expansion had a small immediate impact and a larger long-term impact. It is estimated that the law expansion increased the percentage of rear-seat adults who were restrained in F&PI crashes by 2 percentage points in the first post-law month (November 2020) and by almost 6 percentage points in last month of observation (December 2021). Both effects are statistically significant.

To rule out other factors that could change the restraint use of rear-seat adult passengers, time-series analyses were conducted for the two control groups. The control groups were not targeted by the law expansion but were exposed to the same changes in travel patterns, traffic enforcement, and risky behaviors during the COVID-19 pandemic. The analyses revealed little change in restraint use following the law expansion in the control groups. These results suggest that the adjusted changes in the restraint use of rear-seat adult passengers were driven by the seat belt law expansion, not other factors.

Table 3. Adjusted Change in Percent Restrained of Passenger Vehicle Occupants in Police-Reported F&PI Crashes Following the Seat Belt Law Expansion

Occupants	Percentage Point Change
Treatment group	
Rear-seat passengers 16 and over (immediate effect)	2.4%***
Rear-seat passengers 16 and over (long-term effect)	5.5%***
Control groups	
Rear-seat passengers 15 and under	0.4%
Front seat occupants	-0.0%

Note. All models adjusted for a linear pre-intervention trend in restraint use and changes in the percentage of occupants who were traveling at night, the percentage of occupants who were male, the percentage of occupants in a vehicle with young drivers, the percentage of occupants in a speeding vehicle, and the percentage of occupants in a vehicle with an impaired driver. No seasonality in restraint use was detected. There is very little evidence of autocorrelation in each model. + p<0.1; * p<0.05; ** p<0.01; *** p<0.001

Table 4 presents the estimated effects of the seat belt law expansion on restraint use of rear-seat adult passengers with an elevated risk of serious injury. Both sudden and gradual impact models were evaluated for fit. Because the sudden impact models provided a better fit across subgroups of occupants, only the results for these models are presented. The estimated effect can be interpreted as the average change in percent restrained associated with the law expansion in the post-law months (November 2020 - December 2021).

The results indicate that the law expansion had a positive, if not larger, impact on the restraint use of rear-seat adult passengers with an elevated risk of serious injury. For all rear-seat adult passengers in F&PI crashes, the law expansion increased restraint use by an average of 3 percentage points in the post-law months. In comparison, the law expansion increased restraint use by an average of 5 percentage points

for rear-seat adult passengers traveling at night and traveling with a young driver. These changes are statistically significant. For the control groups, traveling at night or with a young driver, the analyses revealed no significant change in restraint use following the law expansion. These results increased our confidence in the estimated effect of the seat belt law expansion.

The effect on occupants in a speeding vehicle needs to be interpreted with caution. Restraint use of the treatment group increased by an average of 9 percentage points following the law expansion. However, restraint use of the rear-seat passengers aged 15 and under also increased by an average of 5 percentage points. Both changes are statistically significant. Given that the seat belt law expansion should not directly affect the control group, the increase in their restraint use suggests that some confounding factors contributed to the change. The 9 percentage-point increase among rear-seat adult passengers may be partially driven by those confounding factors. However, it is important to note that the increase in restraint use was much larger in the treatment group than in the control group.

Table 4. Adjusted Change in Percent Restrained of High-Risk Passenger Vehicle Occupants in Police-Reported F&PI Crashes Following the Seat Belt Law Expansion

Occupants	Percentage Point Change			
	Overall	Night Driving	Driver Under 25	Speeding Driver
Treatment group				
Rear-seat passengers 16 and over	3.3%***	4.5%*	5.2%***	9.4%*
Control groups				
Rear-seat passengers 15 and under	0.4%	-0.4%	1.3%	4.9% ⁺
Front seat occupants	-0.0%	0.1%	-0.3%	0.3%

Note. All models adjusted for a linear pre-intervention trend in restraint use and changes in the percentage of occupants who were traveling at night, the percentage of occupants who were male, the percentage of occupants in a vehicle with young drivers, the percentage of occupants in a speeding vehicle, and the percentage of occupants in a vehicle with an impaired driver. No seasonality in restraint use was detected. There is very little evidence of autocorrelation in each model. ⁺ p<0.1; * p<0.05; ** p<0.01; *** p<0.001

DISCUSSION

Effective November 1, 2020, New York’s seat belt law was expanded to require passengers aged 16 and older to wear a seat belt in the back seat of a motor vehicle. This study evaluated the effect of the law expansion on seat belt use compliance. The results indicate that the law expansion had a gradual impact on restraint use over the 14-month post-law period (November 2020 - December 2021). The law expansion increased the percentage of rear-seat adults who were restrained in F&PI crashes by 2 percentage points in the first post-law month and by almost 6 percentage points in the last post-law month. Although the rear-seat adult belt use rate (92%) was still lower than the front-seat rate and the rate of rear-seat passengers aged 15 and under (98%) in the post-law period, the gap narrowed substantively.

The effect of the seat belt law expansion on restraint use is relatively small, compared to prior studies of mandatory seat belt laws (Masten, 2007; Wagenaar et al., 1988). The seat belt law may have a ceiling effect when the level of pre-intervention restraint use was already quite high. In our case, 88% of the rear-

seat adult passengers in F&PI crashes were restrained in the pre-intervention period. The small effect could also be due to challenges in raising public awareness of the law expansion and in enforcing restraint use in the back seat of a motor vehicle. According to the 2022 annual survey of New York State drivers, 24% of the drivers surveyed were not aware of the seat belt law expansion. 50% of the drivers surveyed thought it is “very unlikely” or “unlikely” that someone would get a ticket for not wearing a seat belt in the back seat, compared to 23% for not wearing a seat belt in the front seat. The state should continue to publicize the importance of buckling up in the rear seat and strengthen the enforcement of the seat belt law for all seating positions.

Occupants traveling at night, with young or speeding drivers are most in need of occupant protection. The law expansion had a positive, if not larger, impact on the restraint use of rear-seat adult passengers traveling at night, with a young driver, and in a speeding vehicle. However, the post-law restraint use of these high-risk adult passengers remained lower than the average rear-seat adult passengers. Of particular concern are rear-seat adult passengers in a speeding vehicle; only 79% were restrained at the time of the crash in the post-law period. The state should develop strategies to target these high-risk groups in their efforts to raise adult rear-seat belt use.

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