Rollover Protective Structures, Worker Safety, and Cost-Effectiveness: New York, 2011–2017

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Objectives. To measure cost-effectiveness of an intervention to increase retrofitting of rollover protective structures (ROPS) on tractors.

Methods. Tractor overturns are the leading cause of farm fatalities. ROPS prevent these deaths. This study updates a 2011 cost-effectiveness assessment of a New York State intervention to increase use of ROPS. We subtracted intervention cost from the cost of injuries averted, then divided this figure by the number of averted injuries. We used related probabilities and costs of fatalities and injuries from published literature to calculate the program's cost-effectiveness.

Results. The total cost of the injuries averted from 2007 to 2017 was $6 018 742 versus a total program cost of $1 776 608. The one-time retrofit costs will continue to prevent injuries as long as the tractors are used, generating additional (projected) future savings of $12 136 512, $15 781 027, and $18 924 818 if retrofitted tractors remain in operation 15, 20, or 25 years after their retrofit.

Conclusions. Social marketing was cost-effective for reducing injuries from tractor overturns.

Public Health Implications. These results indicate that the intervention model is effective from both a public health and economic standpoint and should be expanded into other states. (*Am J Public Health.* 2018;108:1517–1522. doi:10.2105/AJPH.2018.304644)

See also Forst, p. 1436.

In 2015, the Bureau of Labor Statistics reported 2746 fatalities from 2009 to 2014 in the agriculture, forestry, fishing, and hunting sectors. These totals represent the third-highest number of occupational fatalities across all sectors, after construction and transportation–warehousing, and the highest fatality rate at 23.2 deaths per 100 000 full-time equivalent (FTE) workers. This fatality rate is approximately 7 times higher than the rate across all sectors, which is 3.4 deaths per 100 000 full-time equivalent workers.[1]

A 2002 study found that, nationwide, tractors were the cause of 37% of all agricultural fatalities.[2] Rollover protection structures (ROPS) on older tractors can substantially reduce the risk of injury in the event of a tractor overturn. In 1985, ROPS became standard equipment on tractors; however, many pre-1985 tractors are still in use.[3] Addressing this gap in ROPS protection for older tractors is critical, for 2 reasons. First, tractors are the leading cause of farm-related deaths, and overturns are the principal cause of these deaths. Second, ROPS could virtually eliminate a primary source of agricultural fatalities.[4]

Research shows a clear relationship between the percentage of non-ROPS tractors and the rate of annual tractor-related fatalities. The northeastern United States had the highest tractor-related fatality rate in the nation at 15.4 deaths per 100 000 workers for the years 1992 to 1995.[5] From 2001 to 2004, New York ranked second nationwide in prevalence of non-ROPS tractors (61%), and Pennsylvania ranked first at 62%.[6] Nationwide, the prevalence of non-ROPS tractors decreased from 62% in 1993 to 49% in 2004; between 1992 and 2007, tractor overturn fatality rates declined 28.5%.[3] Swedish studies indicate that fatality rates from tractor overturns fell to nearly zero when non-ROPS tractor prevalence dropped to between 20% and 25%.[7]

The barriers to ROPS retrofitting are significant. A 1996 study found that 40% of New York State farmers would never install ROPS, even if it were free, because of storage concerns.[8] In a similar study, ROPS barriers included finding the right ROPS, availability of the ROPS, transport to a dealer for installation, and cost.[9] In a study of ROPS incentives, researchers offered farmers a range of subsidies for ROPS installation based on a percentage of the total cost to retrofit. As the subsidy increased to 100%, buy-in by farmers increased up to a maximum of 80%.[10]

Over the past few decades, numerous strategies have been employed to address the issue of tractor overturns. These include (1) sales and promotion of ROPS, (2) human factors research to alert the operator of an imminent rollover, (3) reengineering of automatically deployable and cost-effective ROPS, and (4) education.[4] These efforts have led to various levels of limited success. In New York, prior educational efforts had increased awareness of tractor overturns; however, few farmers had considered installing them prior to 2007.[11–14] Knowledge of risks had failed to create behavior change to any substantive degree.[9]

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In 2008, the National Research Council reported that roughly 52% of tractors on farms lacked ROPS.[15] Two years earlier, investigators at the New York Center for Agricultural Medicine and Health launched a social marketing program in New York to overcome financial, logistical, and perceptual barriers to retrofitting. Social marketing identifies a population's needs, values, and barriers to change and designs interventions that match them.[16] The New York campaign used the following approach[9,17,18]:

- *Audience segmentation.* Researchers identified at-risk segments of the farm community. They selected small-scale crop and livestock farms and aimed to ensure that at least 1 or 2 tractors had ROPS protection on each farm.
- *Identify barriers.* Researchers conducted in-depth interviews with farmers. Three themes emerged: (1) "Constant exposures with positive outcomes normalize risk," (2) "Risk is often modeled by family members or coworkers further normalizing risk," and (3) "There is tremendous pressure to reduce costs, save time, and accept risk."
- *Design incentives.* Two incentives were provided: (1) a rebate to reduce cost (New York State provided rebates up to $600 per tractor) and (2) a hotline to assist callers in locating ROPS.
- *Design messages.* On the basis of focus group feedback, the most powerful messages featured the danger to families and the economic burden of a personal disability. Visuals were determined to be highly relevant.
- *Piloting elements of the social marketing campaign.* Researchers selected 4 regions to evaluate campaign impact on the basis of different combinations of intervention components. Piloting of the incentives led to a marked increase in ROPS retrofitting in New York, especially in regions that combined messages and incentives.

A barrier in the expansion of this intervention model has been the lack of widespread state or industry rebate contributions. Given the relatively low cost to fund state-based initiatives (at most $250 000 annually), researchers sought to examine savings over time in a state like New York, which receives adequate rebate funding. In 2010, New York researchers conducted a cost-effectiveness analysis of the intervention and predicted a net benefit of $1 910 000 over 10 years.[19] Now that the program has been operating for 11 years, this analysis seeks to assess the accuracy of original projections and to allow state governments and industry groups to make informed decisions about investments in tractor overturn prevention.

METHODS

We sent an annual survey to individuals who had obtained a ROPS retrofit through the New York ROPS Rebate Program. Participants who had reported an overturn or nearly fatal event in the survey were asked to describe the event. Over time, events have also been reported by participants who contact the hotline. A review of these event reports identified 17 tractor overturns (see the box on page 1518).

On the basis of this information, we calculated exposure time (in years) as the time between the date of the retrofit and either the date of the most recent survey or—in cases where events were reported via a call to the hotline—the date of contact. For participants who never reported an event, we calculated follow-up time as the date of the retrofit until the date of the last survey attempt. We calculated a second measure of total ROPS exposure time as the time from the retrofit date to December 12, 2017. We used these estimates of exposure time in conjunction with the 17 reported overturn events to produce estimates of the number of ROPS tractor years per rollover.

Injury Outcome Analysis

We estimated the number of fatal injuries, disabling injuries, and nondisabling injuries prevented using survey data from a tractor overturn study conducted in Kentucky,[20] combined with estimates published by the Centers for Disease Control and Prevention (CDC).[21] In the Kentucky study, researchers estimated the probability of death or serious injury with a correction for the "healthy worker effect." Briefly, this phenomenon refers to the bias that can occur when workers healthy enough to remain in the work force are included in estimates, whereas those gravely injured leave the work force [illegible] to be overlooked. The correspondin[illegible] rected estimates for death, disabling [illegible] (resulting in hospitalization or perm[illegible] disability), and nondisabling injury are [illegible] 20.0%, and 21.9%, respectively, for a [illegible] ROPS tractor and 1.7%, 3.0%, and [illegible] a ROPS-equipped tractor. The CDC [illegible] mates for the probability of death were [illegible] and 1.7% for a non-ROPS tractor and [illegible] a ROPS-equipped tractor, respectiv[illegible] CDC probabilities of nonfatal injury lac[illegible] degree of granularity necessary to be c[illegible] with the data from the Kentucky stud[illegible] therefore, we derived injury probabili[illegible] clusively from the Kentucky study. Fr[illegible] the probabilities used in the calculation [illegible] and serious injury were as follows:

- *P* death non-ROPS tractor = [0.0[illegible] 0.40[21]]/2 = 0.240,
- *P* death ROPS-equipped tractor = [0.017[20] + 0.017[21]]/2 = 0.017,
- *P* disabling injury non-ROPS tractor = 0.200,[20]
- *P* nondisabling injury non-ROPS tractor = 0.219,[20]
- *P* disabling injury ROPS-equipped tractor = 0.034,[20] and
- *P* nondisabling injury ROPS-equ[illegible] tractor = 0.090.[20]

Cost Analysis

Given these probabilities, we exam[illegible] intervention investments versus injur[illegible] savings based on the choices to retrof[illegible] not retrofit a tractor with the ROPS Pr[illegible] We calculated costs per event by dividi[illegible] program costs by the number of events, [illegible] dollars converted to 2017 dollars usin[illegible] consumer price index (CPI). Program e[illegible] calculations for the New York ROPS R[illegible] Program included total program admin[illegible] and rebate costs from 2007 to 2017. F[illegible] finance rebates were provided by the S[illegible] New York and private donors.

The best estimate of the cost of fat[illegible] nonfatal agricultural injuries is provid[illegible] Leigh et al.,[22] who provide direct and in[illegible] costs. Direct costs include the cost of h[illegible] services, doctors, pharmaceuticals, and in-surance overhead. Indirect costs includ[illegible] wages, but also lost fringe benefits and [illegible] production. These researchers found th[illegible]

REPORTS OF TRACTOR OVERTURNS FROM NEW YORK ROLLOVER PROTECTIVE STRUCTURES (ROPS) PROGRAM PARTICIPANTS, 2006–2017

Case	Incident Details
1	Tractor operator was on a slight side hill when his front tire blew out and the tractor rolled over down the hill.
2	Tractor operator was packing silage when the tire slid off the side of the pile and the tractor tipped over, sliding down the pile. When the tractor landed at the bottom it did a full rollover.
3	While the operator was turning the tractor around, the rear left tire went off the edge of the embankment causing the tractor to turn upside down. The operator was not wearing his seatbelt and jumped off the tractor.
4	The front end of the tractor lifted off the ground; the tractor tipped back until the rollbar stopped it, and then came back down.
5	Tractor operator (youth) was mowing when tractor slid into a deep ditch, landing on its side.
6	Tractor operator was loading the bucket with gravel when the front left spindle broke and the entire wheel came off. The entire tractor tipped to the left hand side.
7	Tractor operator was on a slight grade with a full loader when a rock came loose and got under the rear tire, tipping the tractor to the side.
8	Tractor operator was going to load hay into the third story of a barn. Immediately upon entering the barn the tractor crashed through 3 stories and landed vertically on the bottom level. The rollbar hit the side of the stone wall and propelled the tractor forward about a foot and a half, creating a small space between the tractor and the stone wall.
9	Tractor operator was on a hillside brush-hogging when the tractor hit a woodchuck hole and went over.
10	Tractor operator was planting corn on a steep hill when 1 of the tractor wheels fell off and the tractor went over.
11	Tractor operator was crossing a ditch on a downhill slope when the tractor slid and tipped onto the right side.
12	Tractor operator was brush-hogging on a hillside when the right tire hit a stump and the tractor rolled.
13	Rollover; details unavailable.
14	Rollover; details unavailable.
15	Tip over; details unavailable.
16	Tip over; details unavailable.
17	Unknown roll or tip; details unavailable.

Note. An additional 7 struck-by injuries were averted when the ROPS blocked a falling object; however, these were not included in the analysis because of lack of injury and fatality probability data on these event outcomes.

average fatal occupational injury in agriculture has a direct cost of $69 297 and an indirect cost of $572 180, for a total cost of $641 477. The average occupational nonfatal disabling injury has $16 891 in direct costs and $20 085 in indirect costs, for a total cost of $36 975, whereas the average nonfatal nondisabling injury has $1162 in direct costs and no indirect costs (all costs adjusted to 2017 dollars). We estimated the fatal, disabling, and nondisabling injury costs prevented by the retrofit program by weighting these numbers by the estimated proportion of events that would have resulted in each type of injury, using the probability of such events as identified in the Kentucky study.[20] These cost estimates do not include pain and suffering, emotional effects, or other nonmonetary impacts.

Thus, to estimate the total fatality, disabling, and nondisabling injury-related costs prevented by the program, we used the number of tractors retrofitted each year to estimate the number of fatalities and serious injuries that were prevented each year by the program. We multiplied these by the cost estimates of Leigh et al., which we adjusted using the CPI for fatalities and injuries prevented in 2017 and prior years and a 3% discount rate for fatalities and injuries prevented in 2018 and future years. The 3% discount rate is very close to the current 10-year Treasury bill interest rate, which was 2.88% at the time of our calculations.

RESULTS

Between 2007 and 2017, 1567 tractors were retrofitted with ROPS through the New York ROPS Rebate Program; follow-up data exist for 1054 (67.2%) of these. These 1054 participants reported 17 overturns (see the box on this page). Seven additional participants reported that the ROPS also shielded them from falling objects, thus preventing "struck-by" injuries; however, we did not include these events in cost calculations as injury and fatality probabilities were unavailable. Under the assumption that the experience of the 513 participants without follow-up was similar, dividing the total follow-up time of 3941 ROPS years of exposure by the 17 rollovers reported by these 1054 participants yields an estimate of 1 rollover for every 231.8 ROPS years. Considering the 10 963 ROPS years of exposure accumulated by the cohort as of December 31, 2017, we estimated that 47.3 rollovers (10 963/231.8) have occurred in the cohort.

TABLE 1—Net Injury Outcomes From 47.3 Rollovers, No Rollover Protective Structures (ROPS) Versus ROPS Retrofit: New York State, 2007–2017

	No ROPS		ROPS Retrofit		
Outcome	Probability	Injuries	Probability	Injuries	Outcomes Prevented by Retrofits[a]
Fatal injury	0.24	11.4	0.02	1	10
Disabling Injury	0.2	9.5	0.03	1.4	8
Nondisabling injury	0.219	10.4	0.09	4.3	6

[a]Injuries from "no ROPS" minus injuries from "ROPS retrofit" (rounded off).

Table 1 shows estimates of the number of each type of injury that would occur as a result of these 47.3 rollovers by applying corresponding injury probabilities. The net outcome is the difference between the "no ROPS" and "ROPS" injury outcomes, and is used to calculate the cost of injuries averted by the intervention.

Intervention Costs and Expected Number of Injuries Averted

Program expense calculations included (1) costs of program promotion such as paid media, Web site development and maintenance, and materials development; (2) administrative costs such as salaries, rent, and phone fees; and (3) the total costs of ROPS rebates distributed (Table 2). Rebate costs were the largest programmatic expense, accounting for $975 951 of the $1 629 692 in total funding.

Cost-Effectiveness

On the basis of these calculations, the data suggest that the New York ROPS Rebate Program prevented approximately 10 fatal, 8 disabling, and 6 nondisabling injuries, and a total of $6 018 742 in fatality and injury-related costs, through the end of 2017 (Table 3).

The retrofitted tractors will continue to prevent injuries as long as they remain in operation, at no additional program expense. If the average retrofitted tractor remains in operation for 15 years, then the retrofits installed through 2017 are expected to prevent 22 fatal, 17 disabling, and 13 nondisabling injuries, at a program cost of $33 761 per incident (Table 3).

If, instead, a retrofitted tractor continues in operation for 20 years, program retrofits are expected to prevent 30 deaths, 23 disabling injuries, and 17 nondisabling injuries at a cost of $25 321 per event. A 25-year horizon predicts the prevention of 37 deaths, 29 disabling, and 22 nondisabling at a cost of only $20 257 per event (future dollars are discounted at 3% annually).

Our calculations indicate that the $1.78 million in program investments made through 2017 would result in savings of $13 913 120 in fatality- and injury-related costs if retrofitted tractors remain in operation for 15 years, $17 557 635 if the retrofitted tractors remain in operation for 20 years, and $20 701 426 if the tractors remain in operation for 25 years (Table 3; all savings are in 2017 dollars).

DISCUSSION

The cost of preventing overturn fatalities and injuries is a one-time expense in the form of a ROPS retrofit installation. Once installed, ROPS require little to no maintenance and continue to protect the operator as long as the tractor functions. There is little objective information on how long a tractor remains operational, although observations of farms suggest that it can be decades. As indicated previously, in the initial years of the New York ROPS Rebate Program, the researchers calculated program costs and compared these with associated savings incurred by the prevention of injuries and fatalities.[19] In the present study, we based program savings on the number of overturns identified by ROPS program participants using a decision-tree analysis and data from previous ROPS incident studies.[23,24] In addition, we based associated fatality and injury costs on estimates from Leigh[25] and Viscusi.[26] The conclusions from the earlier cost analysis predicted that savings from 2006 to 2016, as a result of the ROPS Program, wou... $2 229 766 (CPI adjusted to 2017 do...

Given the 10-year span between th... launch of the program and today, a rea... ment of original estimates is timely. A... calculations indicate, the total savings a... a direct result of the program are nea... times greater than originally estimated. Th... striking difference is likely due to co... installation of ROPS on New York tr... over the past 10 years, decreased program costs due to the implementation of pr... efficiencies, and the continued documen... tion of potentially fatal events by partic...

However, these studies are not the ... look at the issue of occupational heal... safety investments from a prevention per- spective. More than 25 years ago, New ... researchers used data provided by fam... members of tractor overturn victims to ... mate average expected income lost.[27] A... time, associated income costs were est... to be close to $250 000 per death (CPI- adjusted figures indicate this number is ... to $450 000 in 2017). In 1992, the pr... total loss of income due to tractor over... New York was calculated to be $2 mil... annually ($3 570 000 in 2017 dollars). A ... paper published by the same author exa... the long-term impact of overturns on the financial viability of the farm.[28] Follow-... interviews with families of overturn vi... indicated that "less than five years afte... accidents, 67% of the families who op... the farms where the accidents occurred ... longer operated them and 44% no longer lived on them."[28(p202)]

Other economic estimates of the soc... costs of fatal and nonfatal tractor over... come from Myers et al.[29] and Pana-Cr... Myers.[24] In these studies, the authors lo... at overall costs of injuries and fatalities ... United States over a 25-year period using annual overturn incidence estimates from 1992 to 2002 for both ROPS and non- ROPS tractors. These estimates indicate ... if all of these events had occurred on tr... equipped with ROPS, the estimated sa... to society between 1997 and 2021 wou... have totaled roughly $1.5 billion in 2... dollars ($1.9 billion in 2017 dollars). The same authors explored additional ROPS strategies by comparing the costs and be... of an "install ROPS" strategy and a "re... tractor strategy." Cost and benefit calcu...

TABLE 2—New York Rollover Protective Structures (ROPS) Rebate Program Expenditures, 2007–2017

Year	Rebates, $	Promotion, $	Administration, $	Web Site, $	Total Nominal $	Total 2017 $[a]
2007	2 632	12 000	35 497	0	50 129	58 838
2008	153 458	12 000	35 497	0	200 955	235 650
2009	101 524	12 000	35 497	0	149 021	170 120
2010	167 169	14 000	35 497	10 000	226 666	254 945
2011	129 181	14 000	35 497	0	178 678	195 188
2012	119 527	15 000	35 497	0	170 024	182 556
2013	83 568	15 000	35 497	10 000	144 065	152 395
2014	68 527	22 500	35 497	0	126 524	132 835
2015	86 865	50 000	35 497	0	172 362	179 649
2016	54 596	50 000	35 497	10 000	150 093	153 259
2017	8 904	16 774	35 497	0	61 175	61 175
Total	975 951	233 274	390 467	30 000	1 629 692	1 776 608

[a]Inflation adjusted to 2017 dollars.

comparisons for each strategy indicated that the "install ROPS" strategy, such as the one utilized in the New York ROPS Rebate Program, is far more cost-effective.

Building on the economic evidence for ROPS installations programs, the National Institute for Occupational Safety and Health (NIOSH) Cost-Effective ROPS (CROPS) designs may provide even greater opportunities for optimizing cost-to-benefit ratios for ROPS installations.[30] These ROPS designs were developed and tested by NIOSH engineers to help farmers build their own ROPS or to assist companies that may be interested in expanding into the ROPS manufacturing market. Estimates of out-of-pocket costs to build a ROPS using these designs is around $500, a much more cost-effective option than ROPS manufactured by original equipment manufacturers (average cost of $635 plus shipping and installation) or after-market ROPS manufacturers (average cost of $1254 plus shipping and installation).[31] Previous research on ideal ROPS price points has demonstrated that farmers are willing to pay around $300 to $500 for ROPS, which makes CROPS designs an affordable option for farmers even without a rebate.[32] This option could also increase competition in the ROPS manufacturing market, which could reduce the price of commercially available ROPS, given the relatively small number of after-market ROPS manufacturers (n = 4). However, tractor manufacturers are vociferously opposed to this option, citing concerns about substandard ROPS construction and liability in the event a farmer-constructed or custom-fabricated ROPS fails. However, Canadian researchers are working on ways to increase ROPS installations using the provision of ROPS designs (Jim Wasserman, Prairie Agricultural Machinery Institute, written communication, 2017). Although the option of custom-fabricated or farmer-constructed ROPS is obviously controversial, our analysis demonstrates that even greater cost benefits could be derived by decreasing the price tag of ROPS equipment.

TABLE 3—Cost-Effectiveness Analysis of the New York Rollover Protective Structures (ROPS) Rebate Program, 2007–2017

Time Horizon	ROPS Years	No. of Potential Injury Events	Program Cost per Injury Event, $	No. of Injuries Prevented by Program: Fatal	Disabling	Nondisabling	Total Injury Costs, $
2007–2017	10 963	24	72 386	10	8	6	6 018 742
Assumed time retrofitted tractor remains in operation, y							
15	23 505	52	33 761[a]	22	17	13	13 913 120[a]
20	31 340	70	25 321[a]	30	23	17	17 557 635[a]
25	39 175	87	20 257[a]	37	29	22	20 701 426[a]

Note. The number of retrofitted tractors was 1567.
[a]Three-percent discount rate. All dollars are inflation adjusted to 2017.

Limitations

Response bias. These findings are significantly influenced by participant survey responses, which indicated that a potentially fatal or disabling injury occurs every 446 years of tractor operation. To check the sensitivity of potential response bias on results, we revised the analysis with the assumption that none of the nonresponders had had a rollover, which would mean that 1 rollover occurs for every 373 years of tractor operation, and that a fatal or serious nonfatal rollover-related injury occurs every 719 years of tractor operation. At this rate, the program would have prevented 6 fatal, 5 disabling, and 8 nondisabling serious injuries up to 2017 (compared with 10, 8, and 6 in the original analysis, respectively) and $3.74 million in fatality- and injury-related costs. This is still higher than the overall program cost of $1.78 million.

Potentially high rate of overturns in the cohort. As our analysis indicates, 10 deaths, 8 disabling injuries, and 6 nondisabling injuries were prevented through 2017 in a cohort of 1567 New York Rebate Program participants with varying ROPS exposure times over an 11-year period. Given the fatalities documented in New York from year to year (10–15 on average), our numbers may seem inordinately high. A potential explanation is that farmers who are at increased risk are more likely to self-select to participate in the program than other farmers in the state.

Potentially higher rates of serious nonfatal injuries in non-ROPS tractor overturns. Lastly, our analysis likely undercounts the cost of overturn-related, nonfatal injuries. A 2002 study with a randomized sample of farm operators in Kentucky found that in 113 overturn reports, 25 and 88 incidents occurred on ROPS-equipped and non-ROPS tractors, respectively.[20] Of the 25 overturns of ROPS-equipped tractors, 1 (4%) resulted in a death on a roadway when the adolescent operator was not wearing his seatbelt and 4 (16%) resulted in injuries requiring emergency care (averaging 3.5 days in the hospital); none of the overturn victims were permanently disabled, and the 4 who were injured experienced an average of 20 lost workdays. By contrast, of the 88 victims of non-ROPS tractor overturns, 24 died, 48 required emergency care (averaging 20 days in the hospital), 10 had permanent disabilities, and most could not work again. The injured lost an average of 104.6 workdays (not including lost workdays beyond 365 days for 10 patients). The costs of these factors are unknown, however, so we used the same cost factors in our comparison between the 2 tractor types, even though the costs of nonfatal injuries are considerably higher for victims of non-ROPS tractor overturns. Moreover, because our analysis assumes a 59% reduction in wages for agriculture compared with all occupations (an assumption made in the study by Leigh et al.[22]), the outcome costs in our analysis may undervalue farmer income. Many small farm households earn most income off the farm.[33]

Public Health Implications

Since the New York Center for Agricultural Medicine and Health piloted this intervention model in New York, it has been adopted by a number of additional states (Pennsylvania, Vermont, Massachusetts, New Hampshire, Wisconsin, and Minnesota). Although ROPS installations have increased significantly in states where rebate funding is available, many high-risk states and industry groups have chosen not to contribute state-based or industry funds for ROPS rebates. However, as our research indicates, this intervention model is effective from both a public health and economic standpoint. **AJPH**

CONTRIBUTORS

T. Kelsey led the statistical analysis, with assistance from all coauthors. All authors contributed to writing and revising the article.

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HUMAN PARTICIPANT PROTECTION

This study was approved by the Bassett Healthcare Network institutional review board.

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