Cost-Effective Driver Improvement Treatment in Pennsylvania

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A written examination developed as one level of a multitiered driver improvement pilot program administered by the Pennsylvania Department of Transportation (PennDOT) was found in a 1-year evaluation period to result in significant reductions in accident and violation involvement rates and a cost savings of at least $150,000 per year relative to prior interventions by PennDOT. The examination and accompanying handbook provided to operators at the 6-point level of negligence conveyed the message that unsafe driving behaviors resulting in accidents and convictions reflect inappropriate choices for particular traffic scenarios and communicated the importance of individuals choosing to avoid specific behaviors that increase accident risk through real-world examples of familiar problem driving situations. Treatment development, administration, and evaluation activities are described.

The development, implementation, and evaluation of a pilot driver improvement program activity in Pennsylvania are described. Treatments at three distinct levels of demonstrated negligence were included in the pilot program. Later, their effectiveness was evaluated in comparison with previously existing postlicensing control procedures administered by the Pennsylvania Department of Transportation (PennDOT).

At Level 1—the first conviction received by a driver with no prior points—the pilot treatment was a personalized version of a warning/advisory letter. The previous practice of PennDOT was to send out an impersonal notice by postcard to first-time offenders. At Level 2, defined as the first time a driver accumulates 6 points on his or her record, a special point examination (SPE) emphasized the understanding of safe driving practices and skills to avoid high-conflict situations, replacing the behind-the-wheel reexamination previously administered by the state police. For Level 3, denoted by the multiple incidence of 6 points on a driver's record, the existing practice of requiring offenders to attend a departmental hearing was augmented in the pilot program with an educational treatment for small groups based on a values clarification curriculum—"Decisions for Safe Driving." The procedures and findings reported in this paper pertain only to the Level 2 SPE.

There was a single, unifying principle in the development of the multitiered pilot program: that unsafe driving behaviors resulting in accidents and convictions reflect inappropriate choices for particular traffic situations. The often-inevitable consequences of such choices can therefore not be explained primarily as events that "just happen" because of external factors, but instead they must be seen as outcomes that are potentially avoidable if drivers' decision-making skills can be improved. For the SPE treatment at Level 2 in this program, a written examination and study guide were developed that reinforce the importance of individual drivers choosing to avoid specific behaviors that increase accident risk. This message was communicated through real-world examples of familiar problem driving situations, both in the study guide and in the format of the majority of test items on the SPE.

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TREATMENT DEVELOPMENT

The existing point system in Pennsylvania provided the framework for development of the SPE treatment in this research. Whereas many different combinations of conviction types can result in the same negligent operator status, in the majority of cases 6 negligent driving points on an operator's record reflects convictions for two moving violations. The placement of an individual in treatment Level 2 (i.e., the SPE) followed from the initial accumulation of 6 points on an individual's record, with allowable treatment alternatives defined in Section 1538(a) of the Pennsylvania Vehicle Code under the authority to require a driver to attend a driver improvement school or undergo a special examination.

The objectives in treatment development were to promote Pennsylvania's driver improvement priorities using interventions—or related approaches—with which earlier studies have achieved positive results. The desired outcome of driver improvement efforts in Pennsylvania is to modify the behavior of negligent drivers to produce measurable gains on accepted traffic safety indicators (i.e., chargeable accidents and selected violations connoting hazardous driving practice).

As noted above, a common thread linking the various driver improvement pilot program interventions is the fundamental orientation toward behavior modification through attitude change rather than through more conventional educational approaches stressing knowledge of rules and regulations or the acquisition of vehicle handling and maneuver skills (e.g., generic defensive driving courses). Pennsylvania's approach emphasizes skill acquisition, but deficient decision skills as opposed to a lack of driving skills are viewed as most responsible for unsafe behaviors. This approach, which is based on cognitive-behavioral theory, emphasizes internal versus external attributions to explain events; in other words, negligent drivers are taught that their traffic violations are the result of their own choices—albeit unconscious ones (*1*). Development of content for the SPE was guided by this tactic of fostering attitude change, insofar as the offenders subject

to this intervention were presented with test and study materials reinforcing the premise of individual choice and responsibility.

The subtasks required to develop the SPE included (*a*) the preparation of a suitable notification letter to inform offenders of their requirement to complete the examination, (*b*) the development of the test content, (*c*) pretesting of the SPE for item comprehension by naive and low-literacy individuals and for examination reliability; (*d*) the development of a driver's handbook to be distributed to offenders when they received the exam requirement notification letter, (*e*) an English-Spanish translation of key examination materials, and (*f*) training of test proctors responsible for administering the examination. The English-Spanish translation and training of test proctors will not be addressed in this paper.

Notification Letter

Following entry of conviction data into the system in Harrisburg, drivers who reached the 6-point level of negligence during the pilot program and who were therefore required to take and pass the SPE were informed of this requirement via a notification letter from PennDOT. The letter conformed to guidelines established during development of the pilot program warning/advisory letter (*2*).

A letter rather than a card was developed for reasons of privacy, as well as the degree of personalization permitted by the letter's expanded format. To emphasize the element of personalization, the offender's name was included in the salutation, and a statement of the specific offenses, associated violation and conviction dates, and points assessed leading to the driver's present SPE status was incorporated into the body of the letter.

Information pertaining to the nature or specific content of the examination was restricted to the accompanying driver's handbook sent to offenders with the notification letter; the letter clearly identified the handbook as the source of this information. With regard to examination scheduling information, a date by which time the offender must have completed the examination was stated in the letter, but the offender was permitted to choose the exact time and place of testing that was most convenient. Finally, the penalty for noncompliance with the examination requirement—removal of the offender's driving privilege for an indefinite period (until the exam is successfully completed)—was highlighted.

The format of the notification letter is shown in Figure 1.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
Bureau of Driver Licensing
Harrisburg, PA 17123

(Address) (Operator record number)

(Date of birth)

Dear Motorist:

Because of your recent violation of Section ___ of the Pennsylvania Vehicle Code on ___, 19 __, and conviction on ___, ___points have been assigned to your driving record. You are required to take and pass a special written examination within thirty (30) days of the mail date of this letter, or your license will be suspended. No extensions will be granted. After passing the examination, two (2) points will be removed from your record, if you pass within the 30 days. If you do not pass the examination on your first try, you may take it again, but not on the same day. A more complete explanation of the examination requirement plus a Study Guide is included in the Handbook which accompanies this letter.

This examination may be taken by appointment only. To schedule your appointment, call 1-800-XXX-XXXX between the hours of 8:00 A.M. and 4:00 P.M., and identify yourself by name and driver's license number to the PennDOT operator who answers. PennDOT will schedule your examination time and location to be as convenient to you as possible. To be admitted to take the examination, you must show this letter and your valid driver's license or other acceptable identification as described in the Handbook. If you show up at the examination location without these items, or at a different time than your appointment, you will not be admitted to take the examination.

It is a violation of the Vehicle Code for you to appear at your special point examination and to show another person's license or someone else to appear showing your license. In either case, both you and the other person will be prosecuted by the Pennsylvania State Police. If your license is currently suspended, this letter does not authorize you to drive to or from your examination location.

A Spanish language version of this letter and the handbook may be obtained by calling the same telephone number given above. (Para obtener ambos, esta carta y el manual, en Espanol Telefones (1-800-XXX-XXXX.)

Sincerely,

Director,
Bureau of Driver Licensing

ALWAYS wear your seat belt--it's the LAW!

FIGURE 1 Notification letter sent to Level 2 drivers required to take the SPE.

Examination Content and Support Materials

This section describes development of specific test items, preparation of alternative equivalent forms of the examination, and pretesting of the examination to measure its reliability.

Test items, set in the context of a series of real-world accident scenario descriptions, required yes/no (true/false) responses evaluating the evidence of "choice" behavior for each involved driver/vehicle in each included traffic conflict situation. The evaluations called for the recognition of unsafe driving practices that were attributed (according to study material and examples presented in the handbook mailed to offenders) to inappropriate driver decisions. The emphasis on driver decision making, in turn, underscored the message of individual choice and individual responsibility, which was fundamental to the ultimate objective of attitude change in PennDOT's approach to driver improvement.

To begin, the creation of test items for the SPE proceeded through a comprehensive review of material implemented in other jurisdictions and was targeted to a comparable (i.e., intermediate) level-of-negligence offender population. To identify all relevant sources and examples of candidate test items, a computer search through data bases including NTIS, TRIS, and PSYCINFO was performed, using the DIALOG access system. From this search, 116 reference citations were identified on the topic of driver improvement programs. The most relevant literature identified was borrowed from Northwestern University's Transportation Engineering Library.

The published record was supplemented by direct queries about research and program development efforts in progress in selected states. Telephone contacts were made with driver licensing officials in 16 states (Alabama, California, Delaware, Florida, Maine, Maryland, Michigan, Montana, North Carolina, North Dakota, Ohio, Oregon, Rhode Island, Washington, West Virginia, and Wisconsin) to identify and gather background information on driver improvement programs and, specifically, written examination materials. Sample copies of these exams were requested. From conversations with these agencies, it was found that very few of these states had driver improvement written examinations or examination material (or programs for that matter). The materials of greatest po-

tential use for developing the written examination in this task were obtained from Montana, North Carolina, Florida, and Washington.

Additional sources contacted to obtain candidate examination material for this subtask included the National Highway Traffic Safety Administration; safety-oriented organizations such as the National Public Services Research Institute, American Automobile Association, National Safety Council, and the Insurance Institute for Highway Safety; and university-affiliated centers for transportation research including the University of Michigan Transportation Research Institute and North Carolina's Transportation Research Center.

As candidate test items were compiled from these sources, an initial screening of content separated items pertaining principally to "rules and regulations" from those more generally addressing safe driving practices; items dealing with the effects of alcohol/controlled substances on driving performance and with vehicle restraint system facts and characteristics were included with the latter category. Items in the safe driving practices category that could be presented using diagrammatic information with a minimum amount of text were accorded the highest preference for inclusion in the SPE, together with information pertaining specifically to sanctions implemented in Pennsylvania.

On the basis of this information, a total of 20 items/responses were developed, with the objective of limiting the time needed to complete the examination to a maximum of 30 min.

Next, the candidate test items were sorted into categories according to content and judged level of difficulty per item. The judgments of difficulty were performed both by project staff and by drivers naive to this project. The outcome of this subtask was three alternative, equivalent test forms.

The content-sorting of items was differentiated among candidates according to specific areas of knowledge and specific driving situations. The knowledge of sanctions (i.e., the consequences of continued negligence) was stressed, in addition to an awareness and understanding of safe driving practices concerning visual search, speed control, and direction/maneuver control. Situational variables considered in the sorting of candidate test items included residential, urban arterial, and freeway driving conditions; night and other low-visibility conditions; roadway geometric variables including vertical and horizontal curvature, intersections, protected and unprotected turning situations, entry and exit ramps from limited-access highways, and high-speed merging-weaving situations; and railroad grade crossings.

The test items—other than those addressing knowledge of sanctions and related traffic safety issues—contained both text and diagram question elements. All questions were edited by literacy experts to ensure their suitability for administration to drivers at a sixth-grade reading level. A preliminary consultation with a literacy specialist addressed broad guidelines for presenting information of this nature in the most easily understood format. The bulk of the literacy screening effort followed preparation of a completed draft of the examination and support materials, however. At this time, the literacy specialist conducted a readability analysis to assess the level of the examination materials, then modified text as required to convey the desired information at the sixth-grade level. The modified text was returned for review by project staff to confirm that the meaning of questions was consistent with original intent.

The diagrams depicted real-world accident scenarios, identifying each contributing or involved driver/vehicle, pertinent roadway geometric features, traffic conditions, visibility and environmental factors, and any additional information helpful in an after-the-fact definition of appropriate and inappropriate driver decisions within a specific situation. Also, more than one test item was generated for each accident description and diagram. In general, test takers were required to discriminate those circumstances in which unsafe practices could be attributed to decisions and to further evaluate the consequences of those decisions as probable causes of the indicated conflicts/accidents diagrammed in the examination forms.

The three alternative, equivalent forms of the examination were prepared by altering the labeling of driver/vehicle question elements for a particular accident diagram and/or rephrasing the question so that the correct response changed from true to false or vice versa.

An example of an accident scenario and accompanying examination question is shown in Figure 2.

It was important to assess the reliability of the SPE before introducing its use to the driving public. If a measuring instrument is to be of any value, the results it produces should be highly consistent and reproducible—this is the operational definition of test reliability.

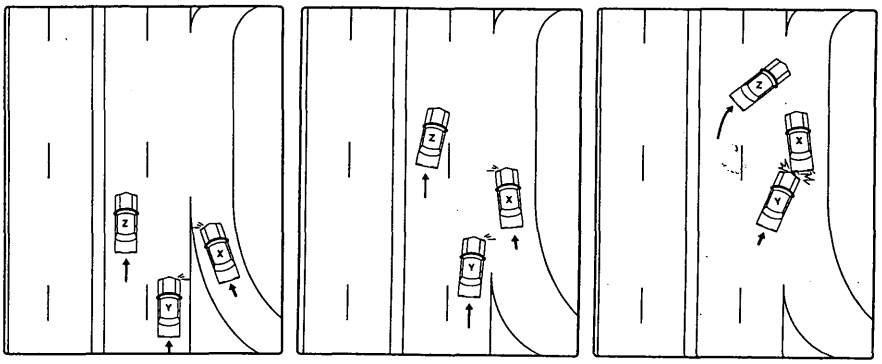
The subject sample selected for examination reliability pretesting consisted of 82 PennDOT personnel who were naive to this project. Each subject completed each of the three test versions; however, the order of completion of the versions was randomized, to rule out the effects of boredom/fatigue. An item analysis was conducted to consider significant asymmetries in the correct response rates for items in the "knowledge" and "accident situation" segments of the SPE and to isolate the probable sources of difference across versions of the examination. Items with correct response rates of less than 70 percent indicated either an unacceptable level of comprehension/retention of study material, exaggerated difficulty of test questions due to the number of included information elements, or awkward wording of the test question. Twenty-six items (across the three versions) therefore underwent revisions after review by the author and PennDOT project management personnel.

Driver's Handbook

As noted earlier, offenders notified by the department that they must complete the SPE received a handbook in conjunction with the notification letter. The handbook was designed to prepare drivers for the exam, specifically, as well as more generally to communicate the overall goals and structure of the driver improvement program and the dependence of safe driving outcomes on safe driving decisions. The handbook contained three sections: The Examination Requirement, Sample Test Items and Study Guide, and General Examination Information.

The initial section explained the examination requirement as it relates to the driver improvement program in Pennsylvania, including information describing the entire range of

Look at the accident diagrammed below, then answer the question at the bottom of the page as if you are Driver Z.



In the first diagram:	A couple of seconds later:	The accident occurs when:
Driver X is speeding up on an entrance ramp to the freeway, with his left turn signal flashing.	Driver X is about to enter the freeway.	Driver Z cuts in front of Driver X to exit the freeway.
Driver Y is traveling in the right lane of the freeway, with his right turn signal flashing.	Driver Y is just beginning to turn toward the exit ramp.	Driver X puts his brakes on hard to keep from hitting Driver Z.
Driver Z is traveling in the left lane of the freeway.	Driver Z begins a sharp turn from the left lane toward the exit ramp.	Driver Y crashes into the rear of Driver X.

QUESTION: Your decision to pass in front of Drivers X and Y to exit the freeway was responsible for the most unsafe act in this accident situation.

TRUE_____ FALSE_____

FIGURE 2 Example of SPE question addressing safe driving practices.

sanctions and remedial program activities triggered by different levels of demonstrated driving negligence. The link between driving negligence and faulty driver decision making was established in this section.

The Study Guide section described the examination's emphasis on knowledge of safe driving practices rather than memorization of traffic rules and regulations, then proceeded with a discussion of critical aspects of driving performance in specific driving situations. The discussion was designed to provide instruction regarding appropriate behavior for the same traffic conflict situations and (search, speed, and direction control) performance factors targeted in the development of the test items themselves. Following this discussion, example items were provided using the same traffic situation diagram approach designed for use in the examination, with each example including the correct answer and an explanation of how that answer is most consistent with the traffic safety lessons presented in the handbook. However, the range of all possible test item situations/questions was not covered in the handbook examples. Instead, apart from questions addressing knowledge of sanctions, examinees were required to generalize from the material presented in the handbook to the specific situation described in a given test item. This represents a clear departure from an approach in which offenders are merely required to memorize a set of facts to match with answer alternatives on an examination. The handbook very clearly communicates this difference to drivers who are required to complete this test.

The section labeled General Examination Information described the mechanics of completing the examination requirement. This included a listing of test sites, scheduling information, how and when drivers would receive official notice of their examination result and consequent license status, how to reschedule the examination if the first attempt resulted in failure, and a description of the examination protocol and expectations concerning behavior at the test site.

The complete handbook is presented as an appendix to the PennDOT final report completed for this project (*2*).

TREATMENT IMPLEMENTATION

The implementation of the SPE in the pilot program was carried out by trained examiners employed by PennDOT. The exam was administered over a 4-month period to groups of

no more than 18 examinees in each of 15 testing centers distributed across the commonwealth.

As noted earlier, the intent of this project was to compare the SPE with the procedure previously used by PennDOT as an intervention at the 6-point level of negligence, a behind-the-wheel (BTW) test of driving skill. The drivers receiving the SPE and the BTW test thus defined the treatment and comparison groups in this research, respectively. All eligible drivers received the SPE during the 4-month period assigned as the "treatment" interval in this project; the comparison interval was the preceding 4-month period, when all eligible drivers received the BTW examination procedure. The resulting composition of the treatment and comparison groups was subsequently screened to ensure that each was composed of unique sets of operators.

The total number of drivers included in the evaluation data set for the SPE was 19,194. The treatment group size was 11,291, or 58.83 percent of the total; 7,903 drivers, or 41.17 percent of the total, were included in the comparison group. Again, these groups were composed of all eligible drivers, statewide, whose conviction experience required completion of the PennDOT Level 2 intervention during the time period in question.

A summary of the age and gender composition of the treatment (T) and comparison (C) groups is as follows: average age_T = 28.7, average age_C = 28.6; age $range_T$ = 16–86, age $range_C$ = 16–83; percent $male_T$ = 78.8, percent $male_C$ = 79.0; and percent $female_T$ = 21.2, percent $female_C$ = 21.0. To help convey the similarity in group makeup, the complete distributions of driver ages for each group are shown in Figure 3.

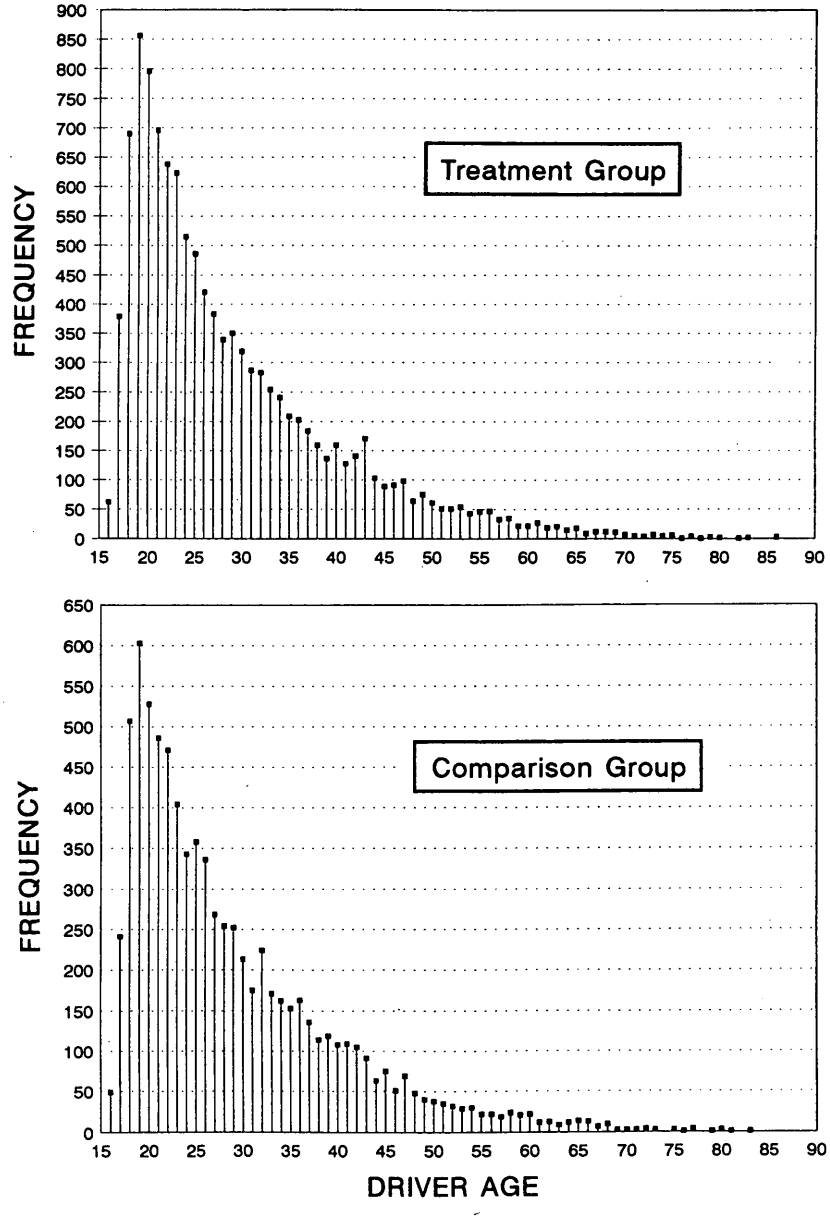


FIGURE 3 Distribution of driver ages for Level 2 treatment and comparison group drivers.

EVALUATION OF TREATMENT EFFECTIVENESS

The effectiveness of the SPE implemented in the pilot program was evaluated in terms of the subsequent accident and violation experience of the treatment and comparison group drivers relative to a specified reference date for each individual in each group.

The dependent measures used to gauge treatment effectiveness included the frequency of driver involvement in three accident and three violation categories. The accident categories included all chargeable accidents, single-vehicle accidents only, and multiple-vehicle (chargeable) accidents only. The violation categories included all point and major nonpoint violations combined, moving (point) violations only, and major nonpoint violations only. The violations included within each evaluation category are presented in Table 1.

Frequency counts for each of the dependent measures for the treatment and comparison groups were obtained at each program intervention level over variable amounts of time, depending on the date of implementation of a given treatment. The project schedule afforded 12-month evaluation periods for violation and for accident experience.

Two analytical procedures were applied to the evaluation data. First, the cumulative percentages of the treatment and comparison groups experiencing their first accident (or violation), on a month-by-month basis after the treatment (reference) date, were plotted. This type of plot is simply the inverse of the traditional "survival curve" that indicates the percentages of each group remaining accident (or violation) free over time. In this type of analysis, treatment effectiveness is demonstrated by a lower (cumulative) percentage of group members having experienced an accident (or violation), relative to the comparison group, at any specified time during the evaluation period.

Next, to determine the significance of observed differences in the relative accident (and violation) experience of the treatment and comparison groups, chi-square (X^2) tests were performed at planned milestones during the evaluation period for each intervention level. The comparisons were performed for the frequencies of accidents (and violations) observed at the 3-, 6-, 9-, and 12-month milestones. Only a single incident (accident or violation) was permitted for any given operator in the treatment and comparison groups for the X^2 tests; multiple incidents were excluded from this analysis of treatment effectiveness. (In fact, it was observed that the numbers of drivers with multiple event involvements at Level 2 in the pilot program were split almost exactly evenly between the treatment and comparison groups.)

TABLE 1 Allocation of Violation Codes to Violation Subgroups

Violation Code	Violation Subgroup	Violation Description
1543	Major NP	Driving while operating privilege is suspended or revoked
3112A3I	Moving Pt	Failure to stop for a red light
3114A1	Moving Pt	Failure to stop for a flashing red light
3302	Moving Pt	Failure to yield half of roadway to oncoming vehicle
3303	Moving Pt	Improper passing-overtaking driver to maintain speed; passing driver to pull in at safe distance
3304	Moving Pt	Improper passing on the right
3305	Moving Pt	Improper passing on the left - clear distance ahead
3306A1	Moving Pt	Improper passing on a hill
3306A2	Moving Pt	Improper passing at a railroad crossing or intersection
3307	Moving Pt	Improper passing in a no-passing zone
3310	Moving Pt	Following too closely
3321	Moving Pt	Failure to yield to driver on the right at intersection
3322	Moving Pt	Failure to yield to oncoming driver when making left turn
3323B	Moving Pt	Failure to stop for stop sign
3323C	Moving Pt	Failure to yield at yield sign
3324	Moving Pt	Failure to yield when entering or crossing roadway between intersections
3332	Moving Pt	Improper turning around - illegal U-turns
3341	Moving Pt	Failure to stop for flashing red lights or gate at railroad crossing
3344	Moving Pt	Failure to stop when entering from alley, driveway or building
3345A	Moving Pt	Failure to stop for school bus with flashing red lights
3361	Moving Pt	Driving too fast for conditions
3362	Moving Pt	Exceeding maximum speed
3365B	Moving Pt	Exceeding special speed limit in school zone
3365C	Moving Pt	Exceeding special speed limit for trucks on downgrades
3367	Major NP	Racing on highways
3542A	Moving Pt	Failing to yield right-of-way to pedestrians in crosswalks
3702	Moving Pt	Improper backing
3714	Moving Pt	Reckless driving
3731	Major NP	Driving under influence of alcohol or controlled substance
3733	Major NP	Fleeing or attempting to elude police officer
3734	Major NP	Driving without lights to avoid identification or arrest
3742	Major NP	Accidents involving death or personal injury
3743	Major NP	Accidents involving damage to attended vehicle or property

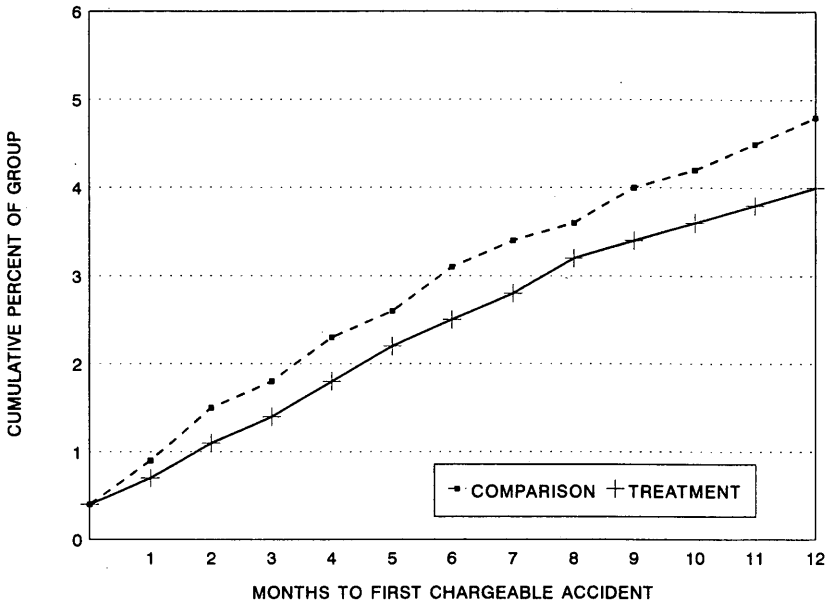


FIGURE 4 Cumulative percentages of Level 2 treatment and comparison group drivers with any chargeable accident involvement each month during the evaluation period.

Results of Analyses of Accident Experience

The curves plotted in Figure 4 describe a consistent benefit of the SPE versus the previously administered BTW exam procedure in terms of the overall chargeable accident experience of the drivers in the present study groups. The superior performance of the treatment group is evident across the entire evaluation period—12 full months; notably, this effect becomes more pronounced at greater intervals after the reference date for each driver.

The strongest difference between the treatment and comparison groups is apparent in the curves describing multiple-vehicle accident involvement (see Figure 5). A separation between the experience of the two evaluation groups that favors the treatment group drivers becomes evident at the end of the first month, and it widens consistently throughout

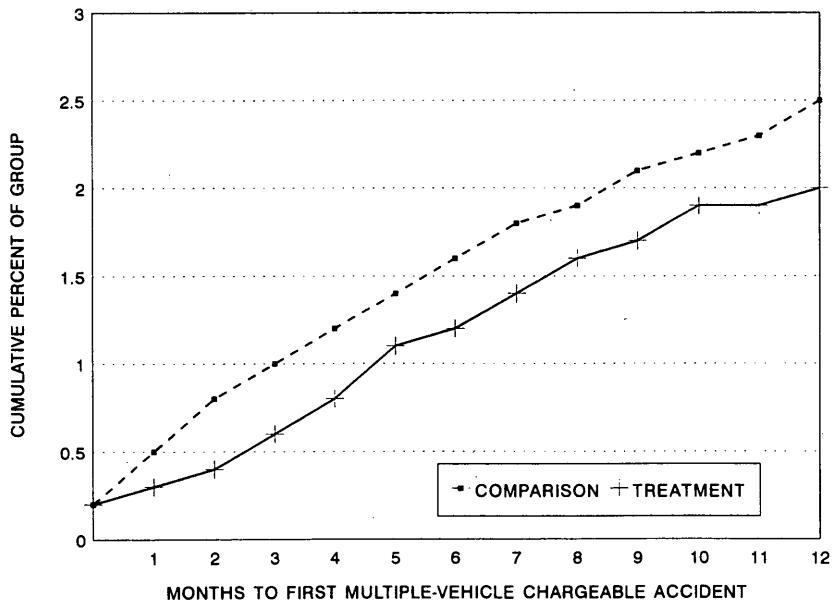


FIGURE 5 Cumulative percentages of Level 2 treatment and comparison group drivers with multiple-vehicle accident involvement each month during the evaluation period.

the year-long evaluation period. With respect to single-vehicle accidents, the experience of the treatment group drivers did not differ appreciably from the comparison group for the first few months, was only slightly (but consistently) superior from Months 3 through 9, then demonstrated a more pronounced benefit by Month 12 of the evaluation period, as shown in Figure 6.

X^2 tests performed on the accident data first indicated significant reductions in accident frequencies for treatment group drivers after 3 and 12 months for the all chargeable accident types category, whereas the reduction in accidents also approached significance at the 6-month ($p < .08$) and 9-month ($p < .09$) intervals. After a 3-month period, the treatment group drivers exhibited significantly fewer than expected accidents, whereas the comparison group drivers exhibited a significantly larger-than-expected number of accidents ($X^2 = 5.41$, df = 1, $p < .025$). After 12 months, the treatment group exhibited a much lower-than-expected frequency of all chargeable accident types, whereas the comparison group accident involvement was higher than expected. This result was significant at $p < .025$ ($X^2 = 5.64$, df = 1).

Next, the treatment group exhibited significantly better performance (fewer accidents) after 3 and 6 months for the multiple-vehicle accidents category, while approaching significant reductions in accidents at the 9-month ($p < .07$) and 12-month ($p < .08$) intervals as well. The superior performance for the treatment versus comparison group drivers was demonstrated by significant chi-square test results, described at the 3-month interval by $X^2 = 10.61$ (df = 1, $p < .005$) and at the 6-month interval by $X^2 = 4.83$ (df = 1, $p < .05$).

No significant differences were indicated when the dependent measure consisted of frequency counts of single-vehicle accidents, though Figure 6 shows a consistent pattern of accident reduction for the treatment group.

Results of Analyses of Violation Experience

As shown in Figure 7, the treatment group drivers experienced a reduced rate of convictions for violations of any type throughout the evaluation period relative to the comparison group drivers. The apparent benefit of the SPE examination was evident at a nearly constant level for a full 12 months.

The curves describing the experience of the treatment and comparison groups for moving/point violations during the evaluation period, as shown in Figure 8, almost exactly reproduce the pattern of results shown for all violations. The benefit of the treatment in reducing major nonpoint violation experience is less apparent, however, since both groups of drivers evidenced identical rates of (first) convictions of this sort at multiple points during the evaluation period (see Figure 9).

For the all violation types category the X^2 tests revealed a significant reduction in the number of violations experienced by the treatment group drivers versus the comparison group drivers at every interval up to and including 12 months from the reference date. These reductions in violation frequencies reached the $p < .005$ level of significance after 3 months ($X^2 = 10.85$, df = 1), 6 months ($X^2 = 12.80$, df = 1), and 12 months ($X^2 = 8.81$, df = 1); at the 9-month milestone the difference was significant only at $p < .05$ ($X^2 = 4.78$, df = 1). For each time period, the treatment group exhibited fewer than expected violation frequencies for the proportion of drivers in the treatment group and the total number of violations received by the sample.

Identical results were obtained for analyses considering the effectiveness of the SPE on frequency counts of moving/point violations only. The treatment group showed significantly fewer than expected moving/point violations at 3 months ($X^2 = 11.80$, df = 1, $p < .005$), 6 months ($X^2 = 11.24$, df = 1, p

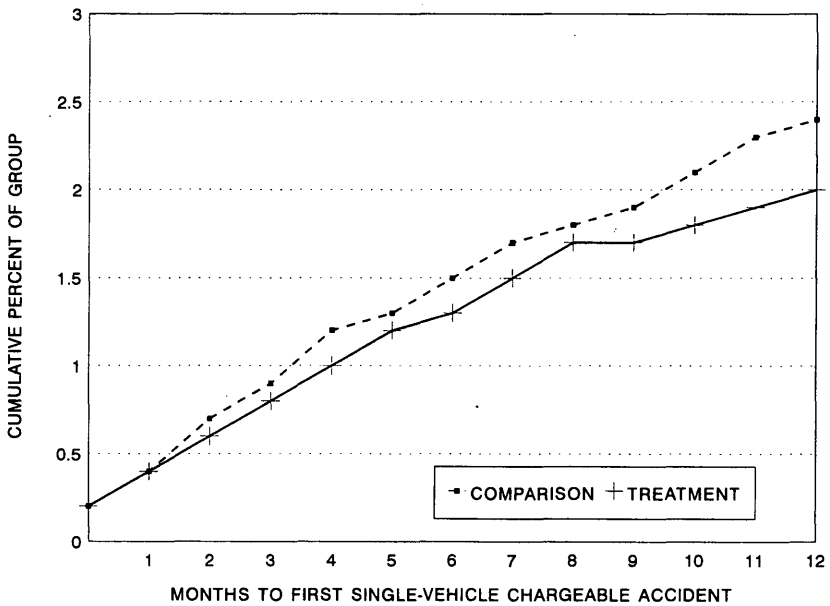


FIGURE 6 Cumulative percentages of Level 2 treatment and comparison group drivers with single-vehicle accident involvement each month during the evaluation period.

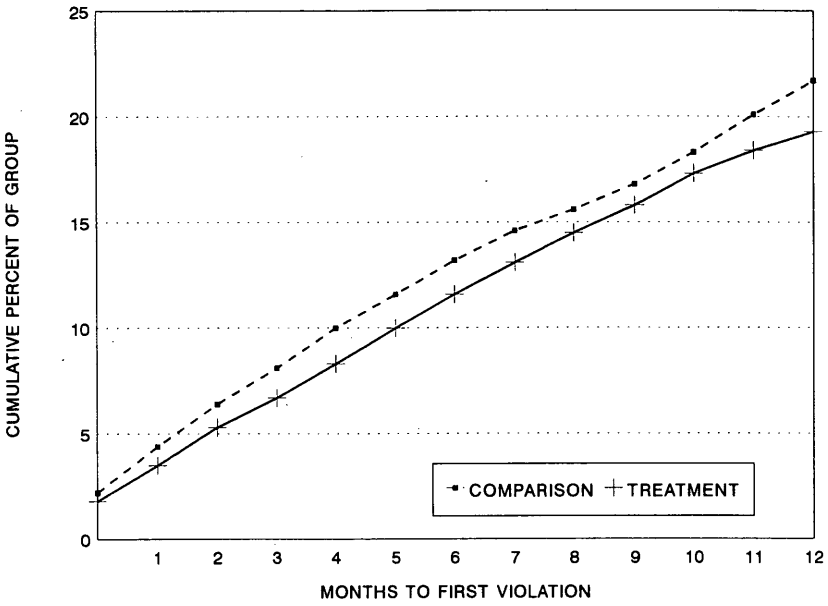


FIGURE 7 Cumulative percentages of Level 2 treatment and comparison group drivers with convictions for any violation type each month during the evaluation period.

$< .005$), 9 months ($X^2 = 5.15$, df = 1, $p < .025$), and 12 months ($X^2 = 8.75$, df = 1, $p < .005$).

Chi-square tests indicated that the SPE treatment had no significant effect on major nonpoint violation experience of the treatment group versus that of the comparison group, although modest gains in performance for the treatment group are apparent in Figure 9 at three of four evaluation milestones.

PROGRAM COST COMPARISON

Before implementation of the Level 2 SPE developed in this research, the equivalent of at least eight Pennsylvania State Police driver license examiners was required to administer the BTW reexamination. Through group administration of the new SPE treatment, personnel requirements for PennDOT

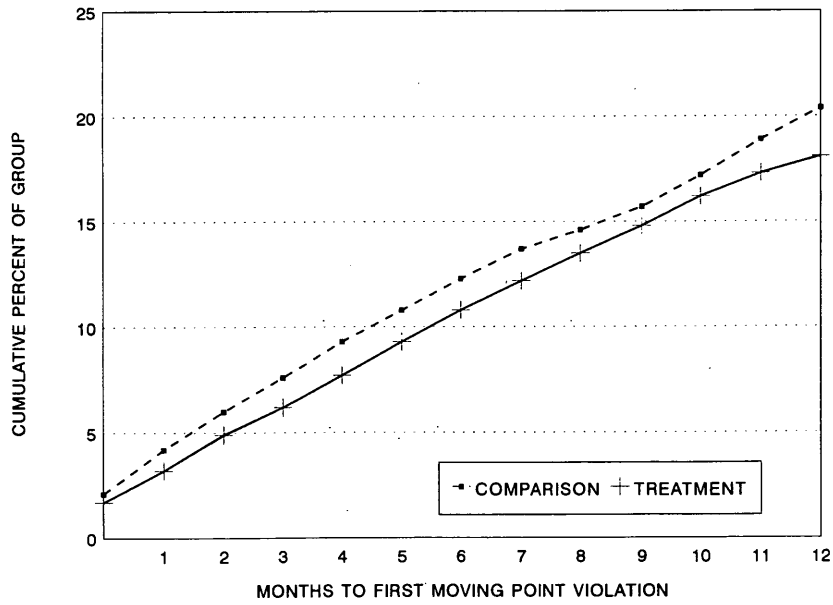


FIGURE 8 Cumulative percentages of Level 2 treatment and comparison group drivers for moving/point violations each month during the evaluation period.

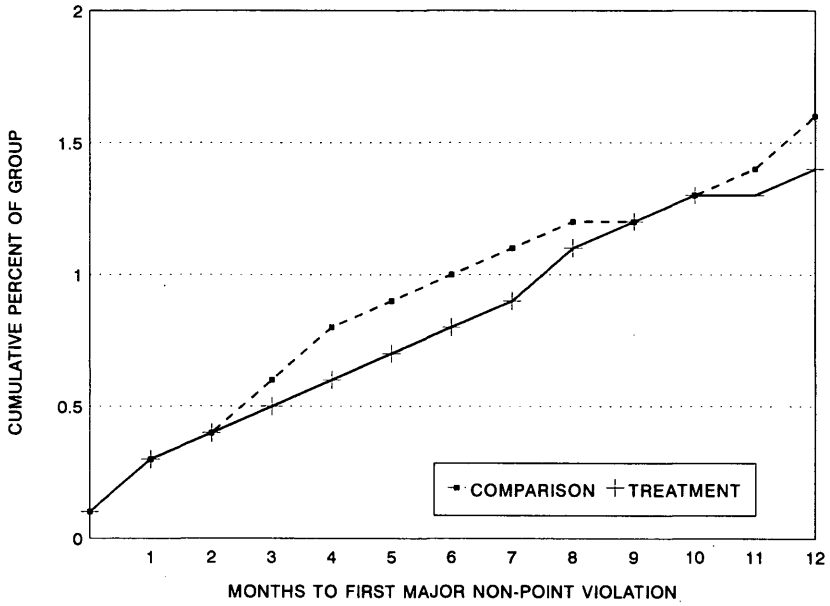


FIGURE 9 Cumulative percentages of Level 2 treatment and comparison group drivers for major nonpoint violations each month during the evaluation period.

were reduced to the equivalent of three driver safety examiners. The net savings to the commonwealth of this change has been conservatively estimated at greater than $150,000 per year by Department of Transportation officials. In the future, automated scoring and examination administration are projected to result in additional savings.

SUMMARY AND CONCLUSIONS

Using the results of related studies of postlicensing control activities in other states as a starting point, pilot program interventions were developed and implemented in this project including an SPE administered to drivers upon first reaching the 6-point level of negligence, most commonly resulting from two moving violations. This intervention stressed safe driving practices rather than knowledge of rules and regulations, and both the study materials distributed to drivers and the examination instrument itself communicated to each individual the responsibility for making safe driving decisions. Exhaustive administration of the novel exam treatment within a bounded (4-month) interval was conducted in this project for all eligible drivers.

Accident and violation data were compiled to evaluate treatment effectiveness over intervals up to 1 year following a "reference date" that was unique to each driver included in the pilot program. Chi-square tests compared the observed and expected frequencies of incidents for the treatment group, who received the SPE, and the comparison group, who received the BTW examination procedure previously administered by PennDOT.

The results of these analyses demonstrated clear and consistent benefits of the SPE, both in terms of violation and (chargeable) accident experience. At every month during the posttreatment evaluation period, a smaller percentage of drivers who passed the SPE had experienced either a single-vehicle or a multiple-vehicle accident than drivers who passed the BTW exam. This difference was statistically significant at the 3- and 6-month evaluation milestones for multiple-accident rates and was still marginally significant at 12 months ($p < .08$). Relative to the fraction of the comparison (BTW) group who had experienced multiple-vehicle accidents 1 year after treatment, the fraction of the treatment group with similar accident involvement was 20 percent lower. For all chargeable accidents, this difference was 16 percent.

An even more consistent and convincing reduction in all violations, and moving/point violations in particular, was found for the SPE. The lowered rates of convictions indicated by these data for the written examination versus the BTW exam were statistically significant at 3-, 6-, 9-, and 12-month milestones during the evaluation period.

These results reflect relative, not necessarily absolute, levels of effectiveness. A true (quasi-) experiment, with random assignment to treatment and control groups, was not a possibility in this research; furthermore, legal constraints in Pennsylvania ruled out the application of the SPE to a treatment group while a comparison group at the same (6-point) level of negligence received no intervention at all. Finally, an item analysis of the SPE to identify particular questions that were most predictive of subsequent driving behavior was not permitted, since hand scoring allowed only pass/fail status to be coded as an examination outcome.

At the same time, the observed decline in posttest accident and violation experience for passing drivers, coupled with the cost savings relative to administration of the prior, BTW examination procedure, was sufficiently encouraging to PennDOT

to support continued administration of the SPE in Pennsylvania, where current usage is projected at 50,000 or more drivers every year.

It was recommended by the report author that the SPE be automated to facilitate test administration, scoring, and record keeping. Presentation of the test items on a CRT could convey accident scenario information more clearly with fewer words, benefiting low-literacy and non-English-speaking drivers. Administrative costs would be lowered further, and security of the test forms would also be greatly enhanced. Additional research to determine whether a related examination approach with test content targeted at a specific user population—for example, young, inexperienced drivers—could demonstrate similar (relative) effectiveness also may be justified by the present findings.

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