EVALUATION OF THE

CALIFORNIA MOTORCYCLIST SAFETY PROGRAM

by

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Submitted To

The Motorcycle Safety Foundation

for presentation at

THE HUMAN ELEMENT
International Motorcycle Safety Conference
March 1 - 4, 2001
Orlando, Florida

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ABSTRACT

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The California Motorcyclist Safety Program (CMSP) is a legislatively mandated, statewide Program that has trained over 100,000 motorcyclists in the ten years since its implementation in July 1987. The program is mandatory for riders under 21 seeking a California motorcycle license.

The current evaluation:

(1) Traces motorcycle accident trends before and after the formation of the CMSP;

(2) Compares accident trends in California with those in the remainder of the U.S.; and

(3) Analyzes the riding records of matched pairs of 2,351 trained and untrained Southern California riders.

Analyses of statewide accident trends show that fatal motorcycle accidents have dropped 69% since the introduction of the CMSP, falling from 840 fatal accidents per year in 1986 to 263 in 1995. If accident trends in California had paralleled those in the rest of the U.S. over this period, the State would have experienced an additional 124 fatalities per year.

In the case of novice riders with less than 500 miles of prior experience, a matched-pair analysis shows that trained riders experience less than half the accident rates of their untrained counterparts for at least six months after training. Beyond six months, riding experience begins to have a leveling effect on the differences between the two groups. In the case of riders with more than 500 miles of experience prior to training or interviewing, no significant differences in accident rates were detected between the two groups, either before or after riders took the basic training course. There was no evidence that riders electing to enter a safety course voluntarily rode any more safely than their untrained counterparts before taking training.

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1.0 INTRODUCTION

1.1 Background

The California Motorcyclist Safety Program (CMSP) is a legislatively mandated, statewide Program that has trained over 100,000 motorcyclists in the ten years since its implementation in July 1987. The CMSP was formed by Assembly Bill (AB) 412, which charged the California Highway Patrol (CHP) with the responsibility for developing and implementing the Program. The CMSP is funded through a $2 per vehicle surcharge on motorcycle registration fees which currently generates approximately $1.3 million annually. Subsequent legislation (AB 3255, effective January 1, 1988) made CMSP training mandatory for all riders under 18 seeking a California motorcycle license. AB 55, which took effect on January 1, 1991, raised the mandatory training age to include all riders under 21 years of age and mandated a formal evaluation of the impact of training on motorcycle accidents. AB 229, which took effect on January 1, 1994, allowed students successfully completing the CMSP course to waive the riding skills test required for licensing by the Department of Motor Vehicles. This paper describes the evaluation activities undertaken to assess the program's impact on motorcycle accidents in California. A more complete report on these activities may be found in the program effectiveness evaluation undertaken in response to AB 55 (*1*).

1.2 Past Research

Since 1980, several states and provinces have attempted to assess the impact of motorcycle training using a matched-sample approach. These include Illinois (*2, 3*), Ontario (*4*), Wisconsin (*5*), Pennsylvania (*6*) and British Columbia (*7, 8*).

TABLE 1 Previous Comparison Studies Evaluating The Effectiveness Of Motorcycle Training: 1980 - 1990

Year	Study Author(s)	Locale	Comparison Years	Sample Size	Sample % Female	Sample Avg. Age	Matching Criteria	Information Sources	Conclusion
1980	Satten	Illinois	--	T: 69 U: 71	52% 26%	34 31	Random	Phone Interviews	Higher accident rate in trained group Higher violation rate in untrained group
1982	Jonah, et al.	Ontario	4	T: 811 U: 1080	23.1% 42.2%	27 21	Random	Phone Interviews; Driving Records	No difference in accident rates Higher violation rates in untrained group
1984	Mortimer	Illinois	1	T: 213 U: 303	8.7% 4.5%	27 27	Gender	Mail Surveys; Site Interviews	Higher accident rate in trained group No difference in violation rates
1987	Leung & Reding	Wisconsin	3	T: 2,914 U: 43,094	56.8% 6.6%	29 25	Endorsement Date	Driving Records	No difference in accident rates Higher violation rate in untrained group
1987	McKnight	Pennsylvania	1	T: 2,424 U: 2,148	32% 30%	35 33	Age, Gender, Endorsement Date, Prior Driving Record	Mail Surveys; Driving Records	No difference in accident rates
1987	Rothe & Cooper	British Columbia	2	T: 418 U: 402	21.9% 16.3%	32 32	Age, Gender, Initial Insurance Data	Phone Interviews; Driving Records	No difference in accident rates; Slightly higher violation rate in untrained group
1988	New York State	New York	2	T: 1,792* U: 2,307*	14% 12%	26 26	Random Pre-selection	Driving Records Mail Surveys	No difference in accident rates No difference in violation rates
1989	McDavid, et al.	British Columbia	5	T: 139 U: 139	0 0	30 30	Age, Gender, Location, Endorsement Date, Prior Driving Record	Driving Records	Lower accident rate in trained group Insignificant difference in violation rates
1990	Rockwell et al.	Ohio	5	T: 1605 U:548,681	43.2%	33	Age; Course Graduates Comp. w/ All Other Lic. Riders	Driving Records	Lower accident rate in trained groups

T = Trained sample
U = Untrained or informally trained sample
*Number includes only licensed riders

1.2.1 Study Findings

Table 1 summarizes the key characteristics and conclusions of matched-sample studies conducted since the early 1980s. Only two of these studies concluded that motorcycle training reduces accidents. In the most recent of the studies listed using a traditional matched pair approach, McDavid (*8*) found that "Trained riders tend to have fewer accidents of all kinds (all motor vehicle accidents combined), fewer motorcycle accidents, and less severe motorcycle accidents. Although these differences are not large in a statistical sense, they suggest that when care is taken to carefully match trained and untrained riders, training is associated with a reduction in accidents."

Accident Impacts. Earlier studies were not able to demonstrate that motorcycle training reduced accidents. In fact, a few of the earliest studies (*2, 3*) found that a straight comparison of trained and untrained riding populations showed that the untrained riders had lower overall accident rates. However, these differences vanished when results were adjusted to reflect differences in age, sex, riding history, exposure, and education between the trained and untrained populations. Rothe and Cooper (*7*) found some evidence to suggest that trained riders had fewer accidents during their first year of riding, but their sample sizes were so small (and the variability of accidents was so high) for this limited period that the finding was not statistically significant. In the end, they reported that "...no conclusions may be drawn concerning the effectiveness of motorcycle rider training in reducing accidents."

Violations. Past studies also give different results regarding the impact of training on recorded motorcycle violations. Although Mortimer (*3*) found no differences in the violation rates experienced by trained and untrained riders, both Satten (*2*) and Jonah, et al. (*4*) found significantly fewer violations among course-takers.

Use of Protective Gear. Satten (*2*), Mortimer (*3*), and Rothe and Cooper (*7*) all found that riders who had taken a motorcycle training course reported that they were more likely to use such safety gear as helmets and heavy reflective jackets. These findings coincide with the results of

telephone surveys conducted with trained and untrained riders in California, which show consistently higher reported use of safety equipment among trained riders (*9*).

1.2.2 Potential Methodological Pitfalls

Although only two of the past studies cited in Table 1 concluded that motorcycle training reduces accidents, most have suffered from methodological difficulties which made it impossible to reach any firm conclusions regarding training effectiveness. These methodological difficulties have been discussed at some length in a separate paper (*10*). The more common of these difficulties are summarized below.

- **Lack of Consistency**. Training programs can differ significantly from state to state, from site to site, and sometimes even from week to week.

- **Self-Selection**. The specter of self-selection bias has often been cited in connection with training program evaluations. It has been argued that riders who take training courses voluntarily may be more safety-conscious than riders who don't take such courses, so that trained riders might be expected to have better accident records than untrained riders. On the other hand, to the extent that riders may be driven to take a course by an accident or a narrow miss, the trained population could also be biased in favor of less safe riders. The only way to circumvent the self-selection problem entirely is by randomly pre-assigning riders to training groups, while denying training to other riders. A random assignment was not feasible under California's current CMSP training program, since training is legally mandated for <u>all</u> license-seekers under the age of 21.

- **Group Comparability**. A few earlier evaluations (*2, 5*) were content to compare the accident records of trained and untrained drivers without controlling for such important characteristics as age, gender, riding experience, and exposure.

- **Oversampling Experienced Riders**. Unless care is taken to obtain matches for a representative sample of trained riders, the danger exists that older, more experienced riders will be overrepresented in the cohort groups. In one matched-pair study, (*6*), the average <u>trainee</u> had 4.5 years or riding experience prior to training while the average untrained rider had 7.9 years of riding experience. It stands to reason that training is less likely to have a measurable impact on an older rider with over four years of experience than on a younger rider coming to the course with no experience whatsoever.

- **Small Sample Sizes**. Several past studies have involved relatively small numbers of subjects. Five of the eight studies cited in Table 1 matched fewer than 1,000 riders.

- **Sample Timing**. Those sampling procedures conducted after the year in which performance is to be evaluated are less likely to detect any differences which might exist between the trained and untrained population. For example, it seems obvious that motorcyclists who have been fatally or seriously injured in accidents are not likely to be responding to surveys.

- **Concurrent Changes**. The act of training motorcyclists may change more than their basic skills. It may also change their attitudes and riding habits. CMSP telephone surveys suggest, for instance, that novice motorcyclists ride twice as much after taking the course as they did before they were trained (*10*).

- **Exogenous Pitfalls**. A number of exogenous events outside the control of program administrators and analysts also have an impact on the evaluator's ability to assess the impact of a training program. These include demographic trends, unlicensed riding, and geographic and climatic differences which affect the riding season.

1.3 Evaluation Overview

The ultimate measure of the effectiveness of any motorcycle training program is its impact on accident rates. The current evaluation takes a three-pronged approach to evaluating the impact of CMSP training on motorcycle accidents in California:

(1) Motorcycle accident trends are traced before and after the formation of the CMSP and the introduction of mandatory training laws;

(2) Motorcycle accident trends in California since the start of the Program are compared with trends in the remainder of the U.S.; and

(3) Matched samples of trained and untrained riders from the Southern California area are developed over a five year period, and the riding records of these pairs of riders are compared for three time periods: (1) Six months after training; (2) One year after training; and (3) Two years after training.

2.0 ACCIDENT TRENDS

This section tracks statewide and nationwide accident trends before and after the formation of the CMSP. In order to track these trends, historical statistics documenting motorcycle accident, registration, and licensing data have been assembled for the ten years preceding CMSP implementation (1977-1986) and for the nine years for which statewide and nationwide data are available since the CMSP began operations in July, 1987 (1987-1995). Accident data over these periods have been broken down by:

- number

- o severity (fatal and injury) and
- o rider age.

In addition, historical DMV data documenting the ages of licensed motorcyclists in five year increments have been assembled for the same time period.

2.1 Accident Totals

Over the first nine years of CMSP operations, fatal motorcycle accidents in California dropped by 69%, falling from 840 fatal accidents in 1986 to 263 fatal accidents in 1995. At the same time, total motorcycle accidents fell from 29,742 in 1986 to 9,710 in 1995, a drop of 67%.

2.2 Fatalities Per Registered Motorcycle

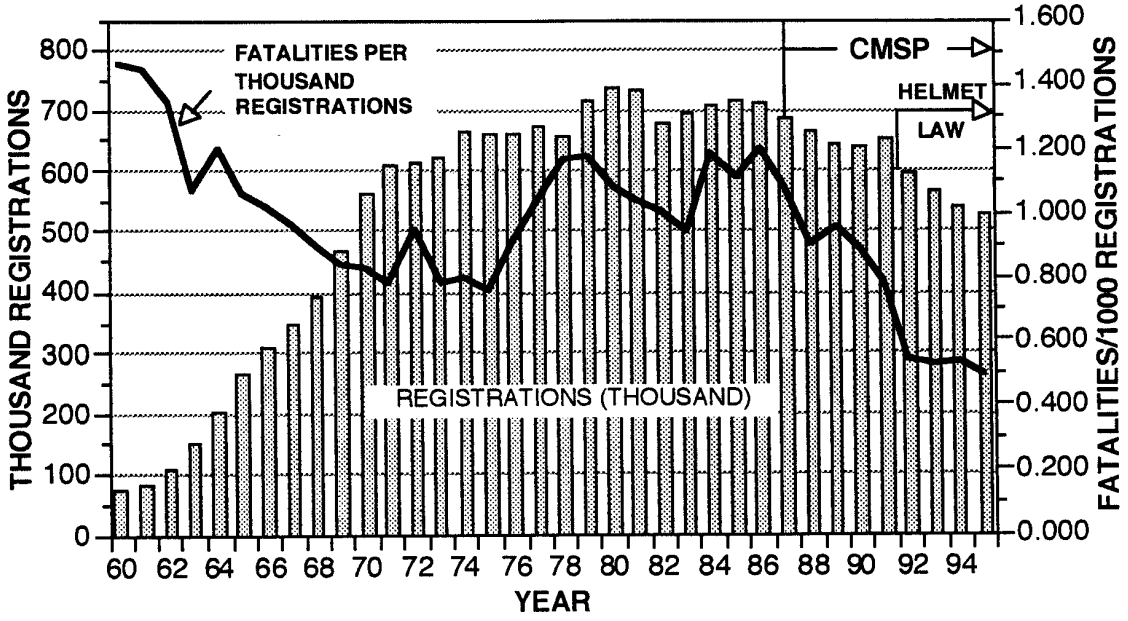

FIGURE 1
Fatalities Per Thousand Registrations

Figure 1 plots the number of registered motorcycles and the number of fatalities per registered motorcycle from 1960, the first year in which motorcycle accident statistics were reported separately, to 1995. As the graph shows, between the introduction of the CMSP in 1987 and the introduction of a mandatory helmet law in 1992, the fatality level dropped from 1.2 to 0.78 fatalities per thousand registered motorcycles. At the time, this equaled the lowest level achieved

since the state first began recording motorcycle fatalities separately. Since 1992, the level of fatalities per registered motorcycle has continued to drop. The current level is 37% below the lowest pre-CMSP level, recorded in 1975, and 59% below the level recorded in 1986, the year before the CMSP originated.

A multivariate time series analysis applied to the trend line of Figure 1 between the years 1978 and 1995 shows that both safety interventions, the CMSP training program and the mandatory helmet law, had a statistically significant impact ($p<.01$ for both interventions) on the level of fatalities per thousand registrations. A similar analysis limited to the years 1988-1991 (after the introduction of training but before the introduction of the helmet law) also showed that training had a significant impact in reducing fatalities per 1000 registrations.

2.3 Accidents Per Licensed Rider

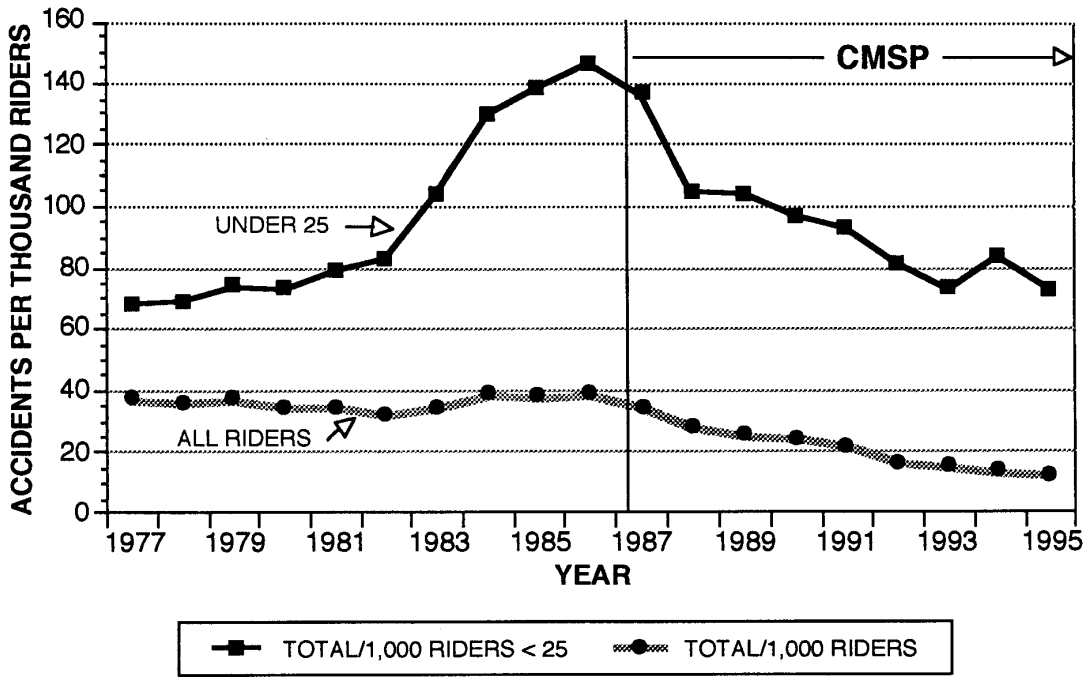

FIGURE 2
Accidents Per Thousand Licensed Riders

Figure 2 plots total motorcycle accidents per thousand licensed riders for the eighteen years between 1977 and 1995. For the total population of riders, the accident rates per thousand licensed riders ebb and flow with the total accident rate, generally rising before 1986 before beginning a continuous drop in 1987. For younger riders under the age of 25, however, the graph shows a remarkable increase in the ratio of accidents to licensed riders during the years just prior to the start of the CMSP. This ratio increased steadily between 1977 and 1986, reaching a peak of 146 accidents per thousand licensed riders in 1986. The ratio dropped slightly in 1987 and dropped still further in 1988, the first full year of CMSP operations. The ratio for younger riders had dropped to 72 accidents per thousand licensed riders in 1995, 50% below the peak achieved in the year prior to the opening of the CMSP. The ratio of total accidents to the entire population of licensed riders has dropped continuously since the formation of the CMSP, reaching a low of 12 accidents per 1000 riders in 1995, 70% below the pre-CMSP peak.

2.4 California Vs. The Rest Of The U.S.

A number of factors besides the formation of the CMSP might explain the pronounced drop in California's accident rates in recent years. These include the aging of the baby-boom population, a precipitous decline in motorcycle sales, and the introduction of the mandatory helmet law in January 1992. In fact, motorcycle accidents have generally been dropping throughout the U.S. in the ten years since the CMSP came into being. It is instructive to compare motorcycle accident rates in California with those in the rest of the U.S. over that period.

2.4.1 Nationwide Trends

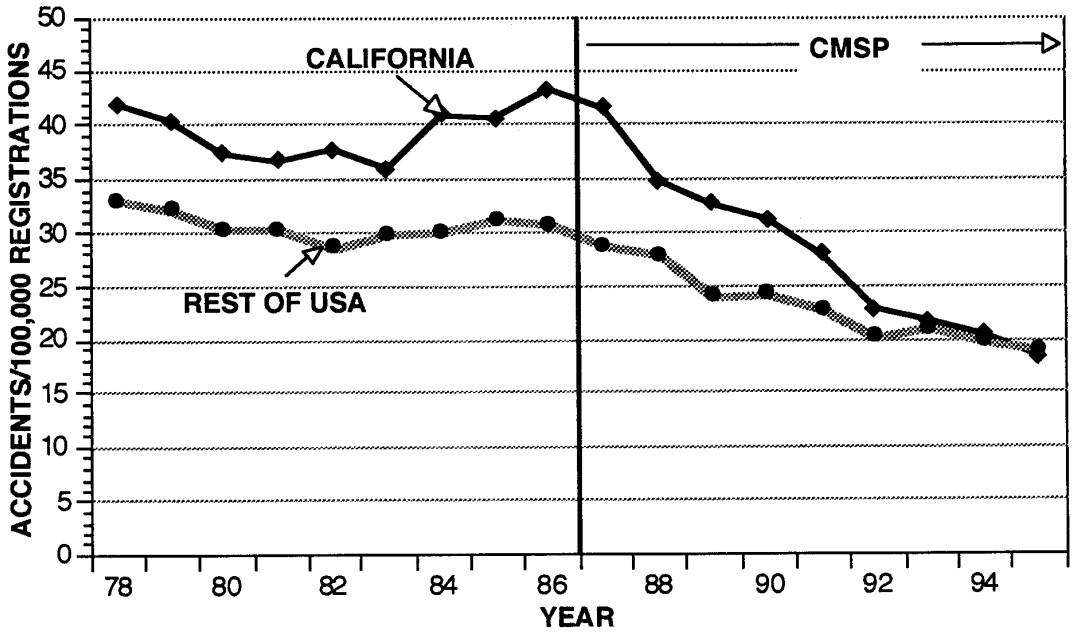

FIGURE 3
Accidents Per Thousand Registrations in California and the Rest of USA

Figure 3 traces the number of motorcycle accidents per thousand registrations in California and the remainder of the U.S. for the years 1978 through 1995.

Accidents Per Registered Motorcycle. The Figure shows that California's accident rate per thousand registered motorcycles was consistently higher than the rate for the rest of the United States prior to the start of the CMSP. Since the Program began, the difference between the two rates has dropped to the point where they are virtually indistinguishable. In 1995, California's accident rate per registered motorcycle dropped below that of the U.S. for the first time in recent history, falling to 18.3 accidents per thousand registered bikes, 3% lower than the average of 18.9 accidents per thousand registrations reported in the rest of the U.S. When accident figures are adjusted to reflect mileage rates, a comparison shows that California's motorcyclists experienced 6.1 accidents per million vehicle miles traveled during 1995, a rate that is actually 27% lower than the 8.4 accidents per million vehicle miles reported outside the state.

2.4.2 Comparative Rates

Overall Rates. A comparison of overall motorcycle accident rates in California since the start of the CMSP with those in the rest of the U.S. shows that the decline of accidents and fatalities in California has far outstripped the decline in the remainder of the U.S. On the average, motorcycle fatalities per thousand registrations in California have dropped by 35.6% since the formation of the CMSP in 1987. Over the same period, the level in the remainder of the U.S. only dropped 20.9%. The relative difference between California and the rest of the U.S. is only slightly less striking when overall motorcycle accidents are considered, with California's overall accident rate dropping 34.3% over the nine years while the rest of the U.S. dropped 27.3%.

Significance of Trends. A multivariate time series regression analysis applied to the difference in accident trends between California and the rest of the U.S. between the years 1978 and 1995 shows that both major safety interventions, the CMSP training program and the mandatory helmet law, had a statistically significant impact ($p=.01$ for training; $p<.01$ for the helmet law) in reducing this difference.

2.4.3 Imputed Savings

Accidents and Fatalities Avoided Through 1995. If post-1986 accident rates in California had paralleled those in the rest of the U.S. over the first nine years of CMSP operations, the State would have experienced 23,042 more motorcycle accidents (2,560 per year) and 1,116 more fatalities (124 per year). While there is no guarantee that the implementation of the CMSP is totally responsible for these imputed savings, the use of the rest of the U.S., as a comparison group helps to screen out some of those factors (i.e. demographic trends, changes in motorcycle riding habits) which tend to obscure the Program's impacts.

Accidents and Fatalities Avoided Through 1991. In order to assess the impact of the CMSP on motorcycle accidents in the absence of the helmet law, it is instructive to examine the decline in motorcycle accidents between the time the CMSP was formed and the time the helmet law came into effect in January 1992. Over this period, motorcycle fatalities in the state dropped by

29%, from 840 fatalities per year to 511 fatalities per year. Applying the same California/U.S. comparison, total fatalities per thousand registrations dropped 21.5% over the five-year period, while the rest of the U.S. experienced a drop of 11.7%. At the same time, California's overall motorcycle accident rate dropped 22% while the rest of the U.S. dropped 17%. If California had paralleled the rest of the U.S. over this period, the state would have experienced an additional 76 fatalities and 1,333 injury accidents per year.

Dollar Value. Using conservative estimates (*11*) of the cost of accidents and fatalities, a savings of 76 fatalities and 1,333 injuries per year represents an annual savings of $113 million, more than eighty times the cost of the Program itself.

3.0 MATCHED-PAIR ANALYSIS

Both the before/after trend analysis and the comparison of California with the rest of the U.S. show significant reductions in motorcycle accidents since the start of the CMSP. The third element of the accident investigation is a matched-pair analysis designed to isolate the impact of CMSP training on specific riders and, in the words of AB 55, to measure "...accident rates of persons completing classes in contrast with persons not having completed classes."

3.1 Approach Overview

3.1.1 Sample Development

Under the matched-pair approach, a profile of the Southern California motorcycling population was obtained by sending on-site interviewers to places where motorcyclists congregate (dealerships, accessory shops, schools, malls, etc.). These profiles identified specific motorcyclists by such key factors as age, sex, years riding, miles ridden/year, and primary purpose of riding (commuting, recreation, etc.). Additional information was gathered (driver's license number, helmet use, etc.) but these five were the primary factors used to match the untrained riders with trained riders for comparison purposes. The five-year sampling process, which was initiated in late 1989, produced interviews with over 16,000 untrained motorcyclists, which in turn produced 2,351 matched pairings with trained riders: 1,139 with riders taking the

basic 16-hour course, and 1,182 with riders taking the 8-hour experienced rider course (ERC). A matched-pair approach was chosen over a factorial approach that modeled the five key factors statistically in an effort to isolate the impact of training on young novice riders. The 16,000 samples obtained in field interviews were heavily biased toward older, more experienced riders.

3.1.2 Survey Follow-Up

As part of the overall evaluation of CMSP activities, regular telephone surveys were conducted with samples of trained and untrained riders, including many of those riders in the matched-pair analysis. Survey responses showed that recent CMSP trainees consistently reported higher usage of such protective equipment as helmets, boots, and jackets than the general population of untrained riders. Survey responses also suggested that although trained and untrained riders had been carefully matched with regard to riding habits prior to training, their post-training riding experience diverged in many cases. To explore these findings in more detail, mail-back surveys were sent to all riders included in the matched-pair analysis in June 1994. Responses from 37% of those samples showed that trained riders tended to ride more after training than their untrained counterparts. Basic course trainees reported riding an average of 5,500 miles during the first year after training, for example, as compared with an average of 4,300 miles reported by untrained riders over the same period.

There is no way of knowing whether the confidence instilled by training leads to added riding, or whether the decision to ride (or ride more often) leads riders to take a training course. In any event, since trained riders were clearly putting more miles on their motorcycles (and hence increasing their exposure to accidents) after training, it was necessary to estimate post-training mileage for all trained and untrained riders so that post-training accident data could be measured in accidents per mile. Wherever possible, survey responses were used as indicators of post-training mileage. Where survey responses were unavailable, regression models were developed relating post-training mileage to prior riding experience. The details of this modeling process may be found in the CMSP ten-year evaluation report (*1*).

TABLE 2 Motorcycle Accidents of Basic Course Graduates and Untrained Counterparts: Before and After Training

TIME PERIOD Prior Experience	No. of Pairs	TRAINED RIDERS Acci-dents	 Miles (1,000)	 Accidents Per 100,000 Miles	UNTRAINED RIDERS Acci-dents	 Miles (1,000)	 Accidents Per 100,000 Miles	Signifi-cance (1-P)	COMMENTS
ONE YEAR BEFORE < = 500 miles >500 miles All	 615 524 1139	 4 12 16	 56 2347 2403	 7.143 0.511 0.666	 5 11 16	 228 2383 2611	 2.193 0.462 0.613	 0.113 0.401 0.409	Accident rate before training is greater for trained riders than untrained riders, but differences are not statistically significant.
SIX MONTHS AFTER < = 500 miles >500 miles All	 615 524 1139	 5 13 18	 1288 1704 2992	 0.388 0.763 0.602	 7 9 16	 820 1225 2045	 0.854 0.735 0.782	 0.065 0.460 0.198	Accident rates of untrained riders with under 500 miles prior experience are more than double rates of trained riders (significant at 90%). No significant differences between rates of riders with more experience.
ONE YEAR AFTER < = 500 miles >500 miles All	 615 524 1139	 12 26 38	 2576 3408 5984	 0.466 0.763 0.635	 10 15 25	 1640 2450 4090	 0.610 0.612 0.611	 0.239 0.221 0.432	Accident rates of untrained novice riders are slightly higher, as are rates of trained riders with more prior experience. Differences are not statistically significant.

3.2 Accident Comparisons

3.2.1 Basic Course Graduates

Table 2 lists the motorcycle accidents accumulated by the matched pairs of basic course trainees and their untrained counterparts for three time periods:

(1) Before training (or interviewing, in the case of untrained riders)
(2) Six months after training (or interviewing)
(3) One year after training (or interviewing)

Basic course graduates have been split into groups on the basis of their pre-training riding experience. Riders having 500 miles or less of riding experience prior to training constitute one group, while riders with more than 500 miles of experience constitute the second group. To rule out any biases introduced by self-reported accidents, the accident figures represent those reported by law enforcement agencies.

Six Months After Training. Overall, riders taking the basic CMSP course had a lower accident rate than their untrained counterparts during the six months following training. The difference in rates was most pronounced for novice riders reporting 500 miles or less of riding experience prior to training. In the case of these absolute novices, the six-month accident rate for untrained riders is 0.85 accidents per 100,000 miles, more than double the rate of 0.39 accidents per 100,000 miles registered by trained riders. This difference in rates was found to be significant at the 0.065 level. (The P-values in Table 2 were computed using the binomial distribution after adjusting for differences in the number of miles ridden by each group.)

In the case of riders with more than 500 miles of experience, accident rates over the six month post-training period were slightly higher for the trained group than the untrained group (0.76 accidents per 100,000 miles vs. 0.74 accidents per 100,000 miles), but this small difference was not found to be statistically significant.

One Year After Training. When accident rates are compared for the first post-training year, the differences observed after six months still assert themselves somewhat, but become less pronounced as the leveling effects of experience bring the two groups closer together. Again,

accident rates for motorcyclists riding 500 miles or less prior to training are lower than the rates for their untrained cohorts (0.47 vs. 0.61 accidents per 100,000 miles) while the accident rates for trained riders with more pre-training experience are slightly higher than their untrained counterparts (0.76 accidents per 100,000 miles vs. 0.61 accidents per 100,000 miles). In all cases, however, the differences between trained and untrained groups were not found to be statistically significant at the .10 level. Thus these comparisons show no significant differences between the accident rates of trained and untrained riders one year after training. This finding is consistent with the results of previous studies, which tended to focus on riders with considerable pre-training experience (See Section 3.4). By the end of the first year, therefore, the added riding experience achieved by both groups of riders washes out the differences observed six months after training.

Two Years After Training. Two years after training, accident rates for the trained and untrained groups continue to converge, and statistical tests show no significant differences between the two groups.

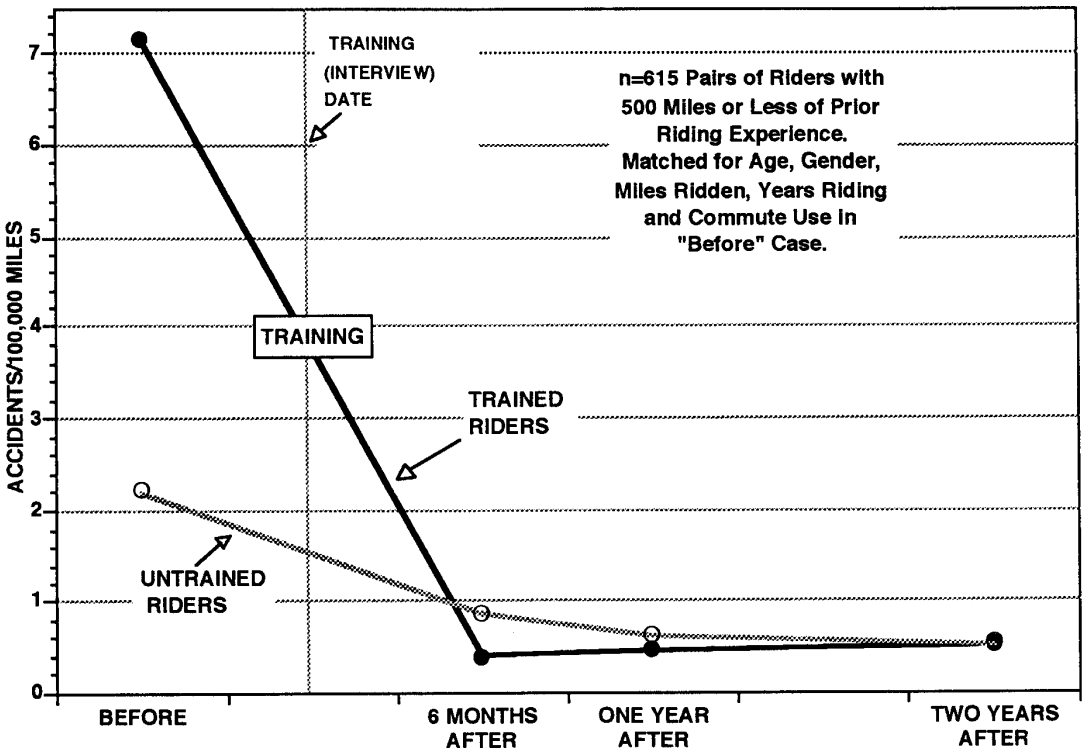

FIGURE 4
Accidents Per Thousand Miles Before and After Training: Matched Pairs of Trained and Untrained Novice Riders

Before/After Comparisons. Figure 4 plots the accident rates before and after training or interviewing for trained and untrained riders with 500 miles or less prior experience. Both groups experience extremely high accident rates during their initial months of riding prior to training (or interviewing), but these pre-training differences were not found to be statistically significant. In the six months following training, the accident rate of trained novices dropped from 7.1 accidents per 100,000 miles to 0.388 accidents per 100,000 miles, a drop which was statistically significant at the .05 level. At the same time, the experience gained by untrained novices caused their accident rate to drop from 2.2 accidents per 100,000 miles in the "before" period to 0.85 accidents per 100,000 miles six months after they were interviewed. Even with this drop, the accident rates of untrained riders were more than double the accident rates of trained riders during the same period. As time elapses and both groups gain more experience, the accident

TABLE 3 Motorcycle Accidents of Experienced Course Graduates and Untrained Counterparts: Before and After Training

TIME PERIOD	No. of Pairs	TRAINED RIDERS			UNTRAINED RIDERS			Signifi-cance (1-P)	COMMENTS
		Acci-dents	Miles (1,000)	Accidents Per 100,000 Miles	Acci-dents	Miles (1,000)	Accidents Per 100,000 Miles		
ONE YEAR BEFORE	1182	26	9967	0.261	20	8891	0.225	0.301	Accident rates for trained riders are slightly higher prior to training, but differences are not statistically significant.
SIX MONTHS AFTER	1182	13	4972	0.261	15	3487	0.430	0.075	During the six months following training, accident rates rise for untrained riders, to the point where they are 65% higher than trained rider rates. Differences are statistically significant at .10 level.
ONE YEAR AFTER	1182	26	9944	0.261	21	6974	0.301	0.298	During the first full year following training, accident rates remain slightly higher among the untrained group, but the differences are not statistically significant.

rates of both trained and untrained riders converge. While the accident rates registered by untrained riders remain slightly higher than those of trained riders, the differences were not statistically significant at the one- and two-year mileposts.

3.2.2 Experienced Rider Course (ERC) Graduates

Table 3 below tabulates the motorcycle accidents of matched pairs of ERC graduates before and after training or interviewing. Riders taking the ERC recorded slightly higher accident levels prior to training than their untrained counterparts, but these pre-training differences were not found to be statistically significant.

During the six months following training, accident rates rose for the untrained groups while remaining stationary for the trained group. As a result, untrained accident rates were 65% higher than trained accident rates during this period. This difference was found to be statistically significant at the 0.10 level. Over the first full year following training, accident rates for untrained riders dropped back near the level recorded by trained riders, and the differences between the two groups were not found to be statistically significant.

3.3 Violation Comparisons

3.3.1 Basic Course Graduates

Traffic violation rates for novice riders also drop lower than those of their untrained counterparts for the first six months after training. Whereas more experienced riders have lower accident rates than novice riders, they tend to have higher violation rates, suggesting that experience and training may lead to an understanding and acceptance of certain types of risks which are not perceived as potential accident threats. Other researchers have observed the same phenomenon. McKnight and Robinson (*12*) noted that "...the inexperienced are somewhat intimidated by the highway traffic environment and therefore compliant with the law. Experience may lead to greater confidence which, in turn, can lead to different perceptions on the part of riders as to what speeds can be safely traveled, what gaps in traffic can be safely accepted, or what maneuvers can be safely executed."

3.3.2 Experienced Rider Course (ERC) Graduates

Experienced riders electing to take the voluntary ERC had significantly lower violation rates than their untrained counterparts prior to training. Although these differences were not reflected in the accident rates of the two groups, they may confirm the speculation of several researchers that riders taking safety courses voluntarily are more inclined to safe practices than riders who elect not to take such courses. The violation rates of experienced riders rose after training, although they never exceeded those of the untrained group. At the same time, the accident rates of ERC graduates remained lower than those of their untrained counterparts, particularly during the six-month period following training.

3.4 Reconciliation With Past Studies

Past attempts to measure the effects of motorcycle training on accident and violation rates in other locations have shown decidedly mixed results. While one recent evaluation in British Columbia (*8*) found that training lowered accident rates, earlier studies in New York (*13*), Pennsylvania (*6*), Wisconsin (*5*), and Ontario (*4*) found training to have no impact on accident rates. One small-sample 1980 study (*2*) found, counterintuitively, that trained riders had higher accident rates than untrained riders. While a few of these past evaluations have been plagued by such pitfalls as mismatched cohort groups, inadequate sample sizes, and potentially biasing sampling procedures, even the best of them have focused on groups of trained and untrained riders who had significant amounts of prior riding experience. The two studies dealing with the largest sample sizes, New York (*13*) and Pennsylvania (*6*), drew their samples from riders applying for licensure. By the time these riders showed up at the DMV, however, they had typically logged several years of riding experience. As a result, these past studies included relatively few untrained riders with no prior riding experience. As the current study shows, however, it is precisely this crucial group of riders, true novices with minimal riding experience, which most benefits from training. As motorcyclists become more experienced, day-to-day riding will help untrained riders overcome the disadvantages of their lack of formal training. Since most

past studies included few true novices in their untrained sample and focused on post-training periods of at least a year, it is not surprising that they failed to detect any differences in the post-training accident rates of trained and untrained riders.

4.0 ADDITIONAL ISSUES

4.1 Parallel Safety Campaigns

In addition to training motorcyclists, the CMSP has launched a number of public information campaigns aimed at improving motorcycle safety and reducing accidents within the state. These information campaigns reach a broader audience than the training population, or even the motorcycling population, and should be acknowledged in any review of the Program's impact on accident trends. Campaign targets have included:

(1) **Motorist Awareness**. The CMSP has worked with the California DMV to include motorcycle awareness materials in the driver's license tests and manual; produced and distributed bumper strips (see below) designed to remind motorists that someone's relatives can be found under the rider's leathers and gear; and posted statewide billboards fostering driver awareness of motorcyclists.

(2) **Unlicensed Riding**. Unlicensed riding is a serious problem in California. The fatality rate for unlicensed riders is three times that of licensed riders, and for the past ten years, an average of 65% of all fatally injured motorcyclists have been operating without a valid motorcycle endorsement. To address this problem, the CMSP has prepared and distributed licensing information and participated in state- and nationwide campaigns reminding motorcyclists that unlicensed riders can have their motorcycles impounded. In addition, AB 229 has encouraged both training and licensing by enabling basic course graduates to waive the DMV skills test required for licensing. In the wake of this activity, over the past two years the unlicensed fatality rate has dipped below 60% of all state motorcycle fatalities for the first time in the past decade.

(3) **Impaired Riding**. In an effort to reduce the incidence of impaired riding in California, the CMSP designed and produced a set of anti-DUI posters, information

cards, and billboards featuring a downed motorcycle and the caption "One for the Road" which were widely distributed during the 1996 riding season.

The overall impact of the indicated public information campaigns on accident rates cannot be known. However, such campaigns should be an integral part of any comprehensive motorcycle safety program. By their nature, they reach a much larger audience than the riders who elect to take a training program. Whereas roughly 25% of the motorcyclists currently active in the state report that they have taken CMSP training, telephone surveys show that over half of California's general riding population recognize the CMSP bumper strip slogan "My (son, daughter, etc.) rides, please drive carefully."

4.2 Self-Selection

Studies investigating the effectiveness of safety courses must address the issue of self-selection. Riders who take training courses voluntarily are presumably more safety conscious than those who don't, so that these safety-conscious riders might be expected to have better accident records than their untrained counterparts even without the course. While most of the trained riders in the matched-pair analysis took training voluntarily, there is little evidence that a self-selection bias is present, at least with regard to accident potential. A comparison of the accident rates of riders taking CMSP courses with their untrained counterparts over the year prior to training showed that the riders taking training actually had slightly higher accident rates prior to training, but that these differences were not statistically significant. This was true for both the basic and experienced rider courses. In other words, there is no evidence that the riders taking training rode more safely than their counterparts in the pre-training period. If anything, the opposite was true.

4.3 The Program As An Effective Sieve

One often overlooked impact of formal motorcycle training is its effect in discouraging some individuals from becoming motorcyclists and keeping riders who should not be on the road from injuring themselves. Follow-up surveys indicate that 16% of those trainees who no longer rode a year after training said that the basic course was a major factor in convincing them not to ride. This represents 5% of all riders taking the basic course and includes a disproportionate number of those failing it. It follows that roughly 3,900 unpromising riders (5% of all basic course students) have been kept off the roads since the start of CMSP operations. If these riders had continued to ride and logged 5,000 miles per year (about average for basic course graduates) and experienced the average accident rate registered by graduates, they would have accounted for roughly 120 accidents per year. Conservatively estimating the cost of a motorcycle accident at $49,500 (*11*), this represents a savings to society of $5.9 million per year. Thus it could be argued that the $1.3 million annual expenditure for the CMSP is more than justified solely on the basis of the unpromising riders it discourages.

4.4 Conclusion

4.4.1 Future Implications

In view of the fact that the primary measurable impacts of training are realized by rank novices with less than 500 miles of prior riding experience, future research efforts and future public information campaigns should target this accident-prone group of riders.

4.4.2 Summary of Findings

Analyses of statewide accident trends show that total motorcycle accidents have dropped 67% since the introduction of the CMSP, with a drop of 88% among the under-18 riders for whom training has been mandatory since 1988. If accident trends in California had paralleled those in the rest of the U.S. over this period, the State would have experienced an additional 124 fatalities per year. A matched-pair analysis shows that the accident rates of untrained novice riders are

more than double the rates of their trained counterparts for at least six months after training, when riding experience begins to have a leveling effect on the differences between the two groups. By any measure, the CMSP is a cost-effective Program that pays for itself many times over in saved lives and reduced accident rates.

ACKNOWLEDGEMENTS

The work described in this paper was performed under contract to the California Highway Patrol. It was originally published by the Transportation Research Board as part of their Transportion Research Record No. 1640 in November 1998.

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