# EVALUATION OF A CONTACT LETTER TO INCREASE LICENSURE AMONG IMPROPERLY LICENSED CALIFORNIA MOTORCYCLE OWNERS

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**Authors: Kevin J. Limrick**
**Scott V. Masten**
**Research and Development Branch**
**Licensing Operations Division**



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**14. ABSTRACT**

This report presents results of an evaluation of a pilot program intended to increase licensure among improperly licensed California motorcycle owners. The intervention used in this pilot program involved mailing an official DMV contact letter to owners of currently-registered motorcycles who were not properly licensed to ride two-wheeled vehicles. This correspondence informed the recipient of the legal consequences of riding without proper licensure, and provided information regarding how to obtain a motorcycle license in California. Half of the improperly licensed motorcycle owners ($n$ = 33,068) were randomly assigned to be mailed the contact letter. The remainder ($n$ = 32,698) served as a no-letter control group. The 33-month subsequent-to-mailing license status and 18-month subsequent-to-mailing driver records for participants in these two groups were compared to determine the effect of the letter on motorcycle licensure, crashes, and violations. The results indicate that the contact letter increased motorcycle licensure among most age groups of owners, but did not affect crash involvements or traffic violations. The contact letter increased the number of previously unlicensed owners who became legal motorcycle operators without increasing their crash or traffic violation rates, but at a total net cost of $25.81 per additional owner who became properly licensed as a result of sending the letters. While the letter treatment significantly increased the motorcycle licensure rate, the overwhelming majority of treated owners in the present study (85.5%) remained improperly licensed to operate two-wheeled vehicles on public roadways, which is consistent with the results from a similar study in Maryland (Braver et al., 2007). Given the relatively low cost of treatment, the increase in motorcycle licensure associated with the letter, and the traffic-safety neutral outcomes, it is recommended that future use of a contact letter for improperly licensed owners be considered if the value of bringing owners into legal licensing status is deemed to be worth the cost of treatment. Future letters may be more effective if they are specifically tailored to the demographic characteristics (e.g., age and sex) of the unlicensed owners.

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## Preface

This report presents the results of an evaluation of a pilot program that sought to increase motorcycle licensure among motorcycle owners in California who were not licensed to operate two-wheeled vehicles on public roadways. This project was made possible through the support of the California Office of Traffic Safety and the National Highway Traffic Safety Administration. This report was prepared by the California Department of Motor Vehicles Research and Development Branch. The findings, opinions, and conclusions expressed in this report are those of the authors and not necessarily those of the California Office of Traffic Safety, the National Highway Traffic Safety Administration, or the State of California.

## Acknowledgements

This project was conducted under the general direction of David DeYoung, retired Research Chief. Robert Hagge, former Research Manager II and current Research Chief, supervised the project, contributed to the design of the study and statistical analyses, and edited drafts of the report. Mike Gebers, Research Scientist, helped develop the statistical approach used to analyze the data. Doug Rickard, Associate Government Program Analyst, helped create the data tables and format the final report. Jeffrey Moulton, former Graduate Student Assistant, helped with the literature review and tracking of undeliverable letters.

## Executive Summary

*Background*

- The number of fatal crashes involving motorcyclists in California rose 137% from 1999 through 2008. Roughly one-third of the riders involved in these fatal crashes were not properly licensed to operate a two-wheel motorcycle at the time of the crash.

*Project Description*

- The department implemented and evaluated a pilot program to (1) increase motorcycle licensure among registered motorcycle owners who were not properly licensed to ride two-wheel motorcycles in California, and (2) reduce the crashes and traffic law violations for these individuals.

- The program consisted of mailing an official contact letter to registered motorcycle owners who lacked the proper license or permit required to operate a two-wheel motorcycle on public roadways. The letter described the legal and financial consequences of being cited by law enforcement for riding while improperly licensed, provided information on how to obtain a motorcycle license or permit, and gave contact information regarding the Basic Rider Course of the California Motorcyclist Safety Program (CMSP) administered by the California Highway Patrol (CHP).

*Methods*

- Two files were created of data extracted from the department's driver license and vehicle registration databases. One file contained records for all currently registered motorcycles in California and the other contained records for all individuals with a California license, endorsement, or learner permit to ride two-wheel vehicles. These two files were matched on driver license number, which identified 65,766 motorcycle owners who did not possess a motorcycle license, endorsement, or learner permit.

- Half of the improperly licensed motorcycle owners ($n$ = 33,068) were randomly assigned to be mailed the contact letter. The remainder ($n$ = 32,698) served as a no-letter control

group. The 33-month subsequent-to-mailing license status and 18-month subsequent-to-mailing driver records for participants in these two groups were compared to determine the effect of the letter on motorcycle licensure, crashes, and violations.

*Results*

- Thirty-three months after the contact letters were mailed, the percentage holding a motorcycle license or learner permit was significantly higher for participants who received the contact letter (14.5%) than for participants who did not receive the contact letter (10.4%). This equates to a 39% increase in motorcycle licensure associated with the contact letter.

- The letter did not significantly affect motorcycle licensure status for the youngest group (under 20 years), though it did significantly increase the odds of subsequent motorcycle licensure for owners aged 20 to 34 (21%), 35 to 54 (47%), and 55 and older (96%).

- The letter did not have a statistically significant effect on any of the 18-month subsequent crash involvement or violation measures.

*Conclusions and Recommendations*

- The contact letter increased the number of previously unlicensed owners who became legal motorcycle operators without increasing their crash or traffic violation rates, but at a total net cost of $25.81 per additional owner who became properly licensed as a result of sending the letters. While the letter treatment significantly increased the motorcycle licensure rate, the overwhelming majority of treated owners in the present study (85.5%) remained improperly licensed to operate two-wheeled vehicles on public roadways, which is consistent with the results from a similar study in Maryland (Braver et al., 2007). Given the relatively low cost of treatment, the increase in motorcycle licensure associated with the letter, and the traffic-safety neutral outcomes, it is recommended that future use of a contact letter for improperly licensed owners be considered if the value of bringing owners into legal licensing status is deemed to be worth the cost of treatment. Future letters may be more effective if they are specifically tailored to the demographic characteristics (e.g., age and sex) of the unlicensed owners.

# TABLE OF CONTENTS



# LIST OF TABLES

TABLE OF CONTENTS (continued)

LIST OF TABLES (continued)



LIST OF FIGURES

TABLE OF CONTENTS (continued)

LIST OF FIGURES (continued)

NUMBER PAGE

# Introduction

## Background

The number of motorcycle riders (operators) involved in fatal crashes in the United States increased 114% from 1999 through 2008 (NHTSA, 2011). In California, 4,169 motorcycle riders were involved in fatal crashes over this 10-year period, representing a statewide increase of 137% from 1999 through 2008 (Figure 1).

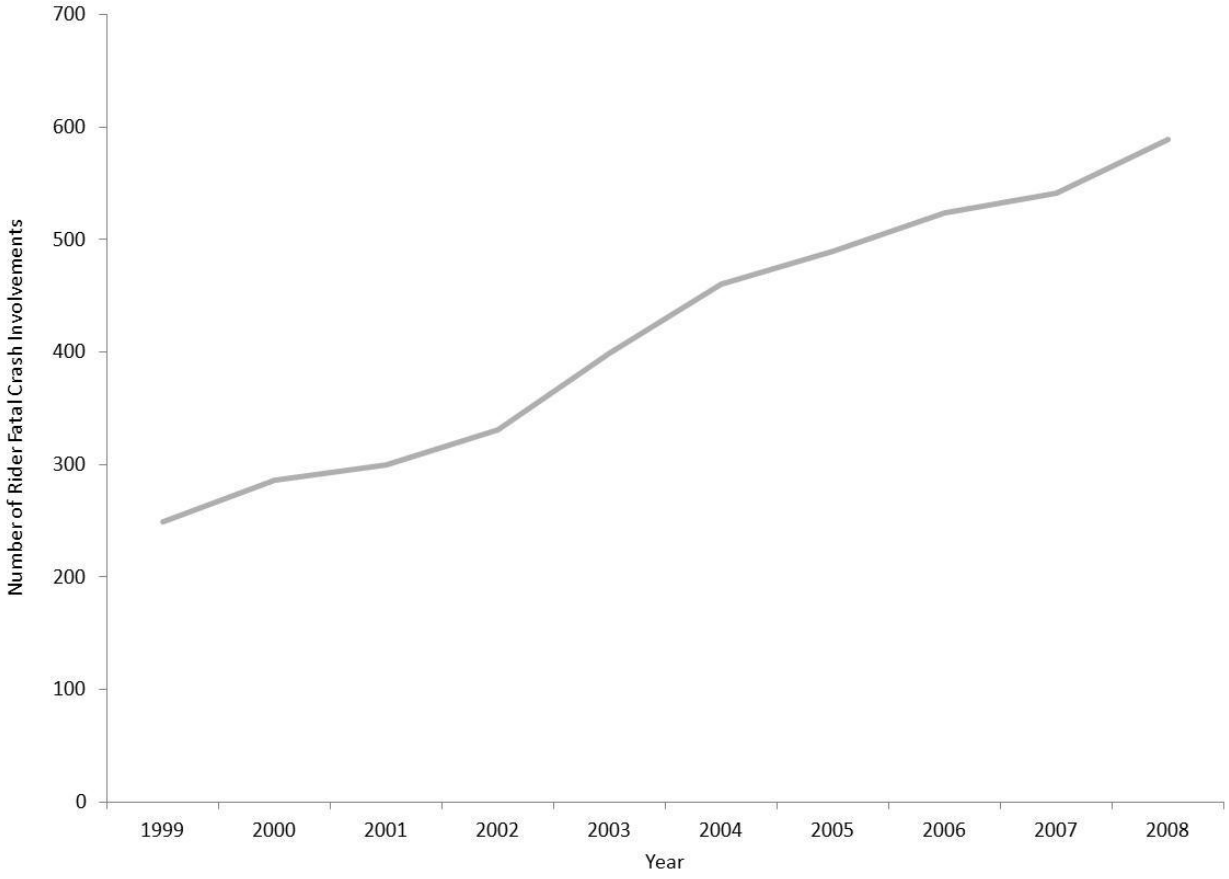


*Figure 1.* Annual number of motorcycle riders involved in fatal crashes in California from 1999 through 2008. Data obtained from the Fatality Analysis Reporting System Encyclopedia at http://www-fars.nhtsa.dot.gov/Main/index.aspx. The statistics provided on the website are compiled from annual *Traffic Safety Facts* reports published by the U.S. Department of Transportation.

As illustrated in Figure 2, the increase in fatal crash involvements in California occurred for riders of all ages, with each age group experiencing an overall rise in fatal crash involvements from 1999 through 2008 (NHTSA, 2011). It should be noted here that references to "fatal crash involvement" within this document signify that a motorcycle rider was merely involved in a fatal crash; it does not imply that death in each instance was that of the motorcyclist.

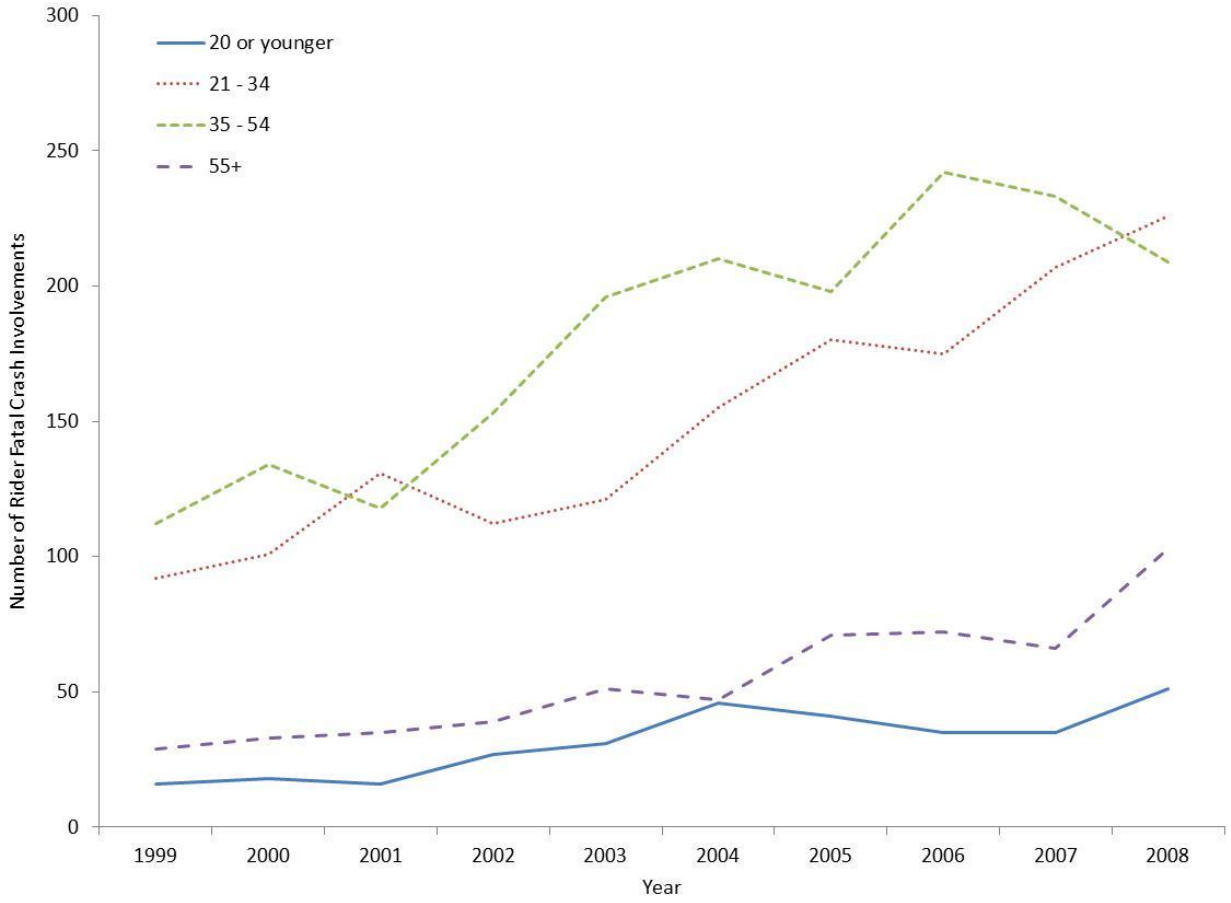


*Figure 2.* Numbers of motorcycle riders involved in fatal crashes in California from 1999 through 2008 by age group. Data obtained from the Fatality Analysis Reporting System Encyclopedia at http://www-fars.nhtsa.dot.gov/Main/index.aspx. The statistics provided on the website are compiled from annual *Traffic Safety Facts* reports published by the U.S. Department of Transportation.

Mirroring this marked increase in fatal crash involvements is the more than doubling of the number of registered motorcycles in California over the same period (Figure 3), with nearly 400,000 more registered motorcycles in 2008 than in 1999.

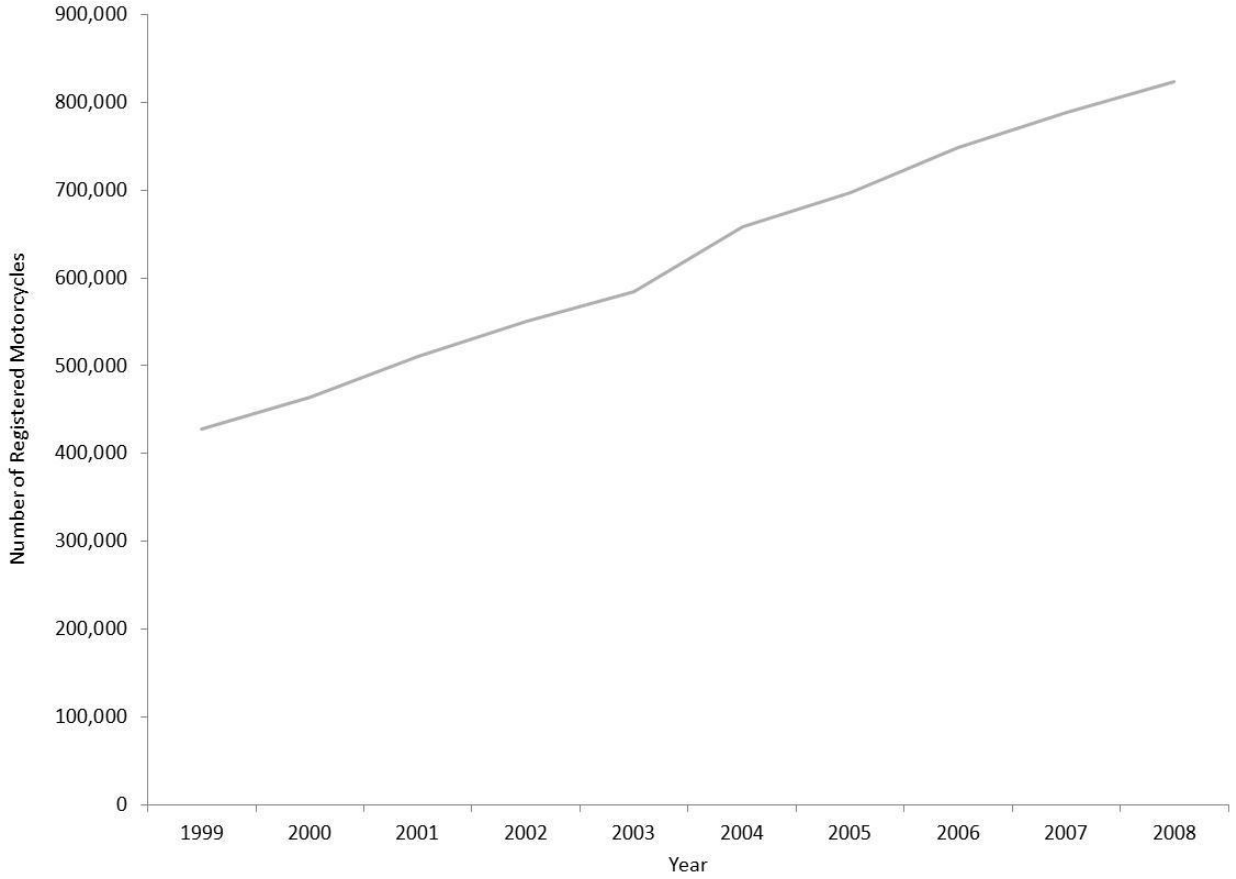


*Figure 3.* Numbers of registered motorcycles in California from 1999 through 2008. Data obtained from the Department of Motor Vehicles' internal report on vehicle registration titled *Estimated Fee Paid Vehicle Registration by County*.

The number of licensed motorcyclists in California increased 44% during this period, from 844,011 in 1999 to over 1.2 million motorcycle licensees in 2008. As shown in Figure 4, this increase in licensees occurred for all age groups. Evident from Figure 4 are the comparatively low numbers of young licensees (age 20 or younger), which is consistent with their low representation among licensed drivers generally.

Figures 3 and 4 do not include riders with motorcycle learner permits, which allow riding under certain restricted conditions, as discussed later in this report. Since the department does not routinely track counts of motorcycle permits, it was not possible to provide permit volumes in this report. However, it was possible to estimate from various departmental data sources that permit holders currently represent roughly 10% of the total number of riders who are licensed or

permitted to ride, and that the likelihood of holding a permit rather than a license is much higher for young riders. For the four age groups shown in Figure 4 (from youngest to oldest) permit holders represent roughly 40%, 20%, 5%, and 2%, respectively, of the licensed or permitted motorcyclists within each age group.

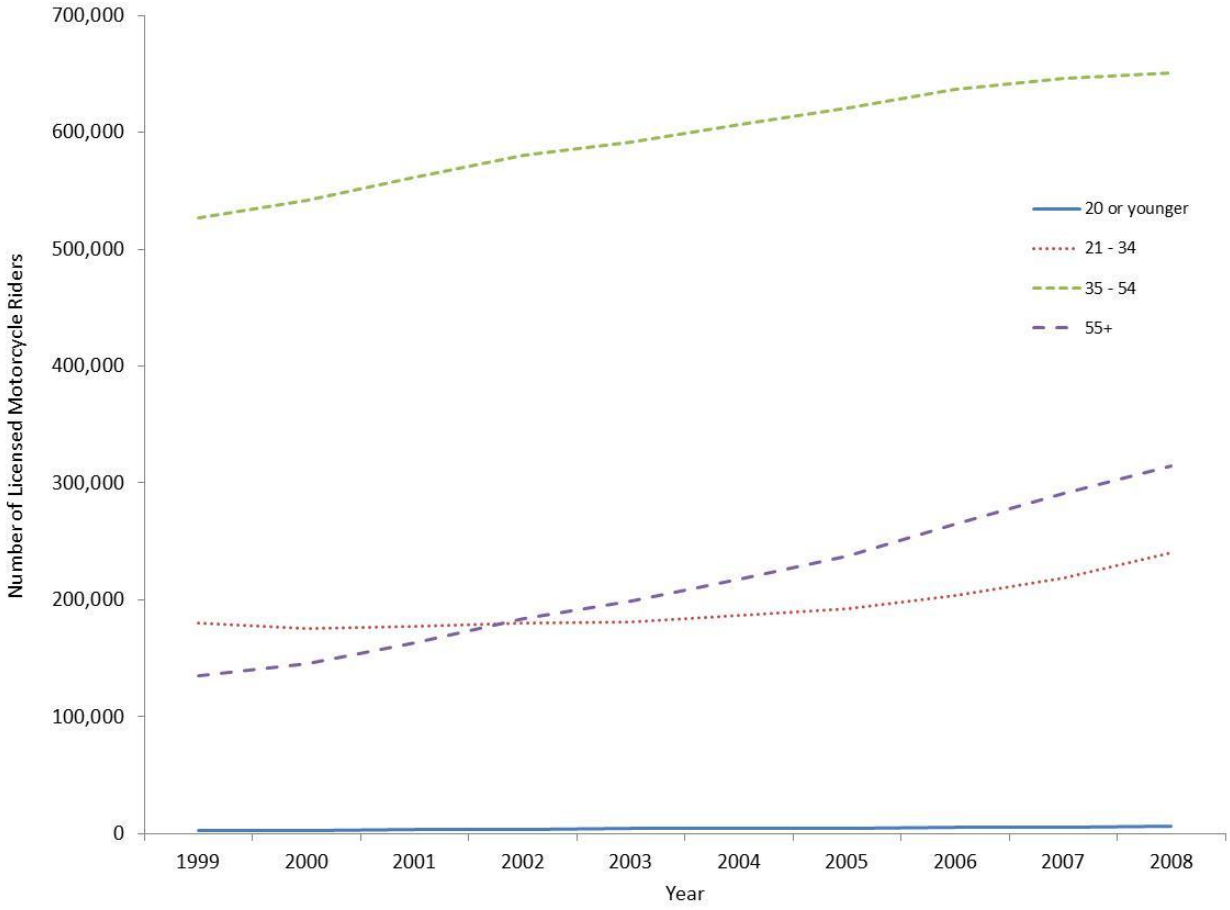


*Figure 4.* Numbers of licensed motorcycle riders in California from 1999 through 2008 by age group. Data obtained from the California Department of Motor Vehicles' internal *Driver License Information Report*. The count for each year was obtained in January of the following year. Motorcycle learner permits are not included.

Of particular relevance to the present study is the fact that a large percentage of motorcycle riders involved in fatal crashes in California during the past decade were not properly licensed to drive a two-wheel motorcycle. Figure 5 shows the percentage of motorcycle riders involved in fatal crashes in California from 1999 through 2008 who did not have a valid motorcycle license

or permit at the time of the crash. As can be seen, improperly licensed motorcyclists represented 28 to 37% of all motorcyclists involved in fatal crashes each year during the time period shown.

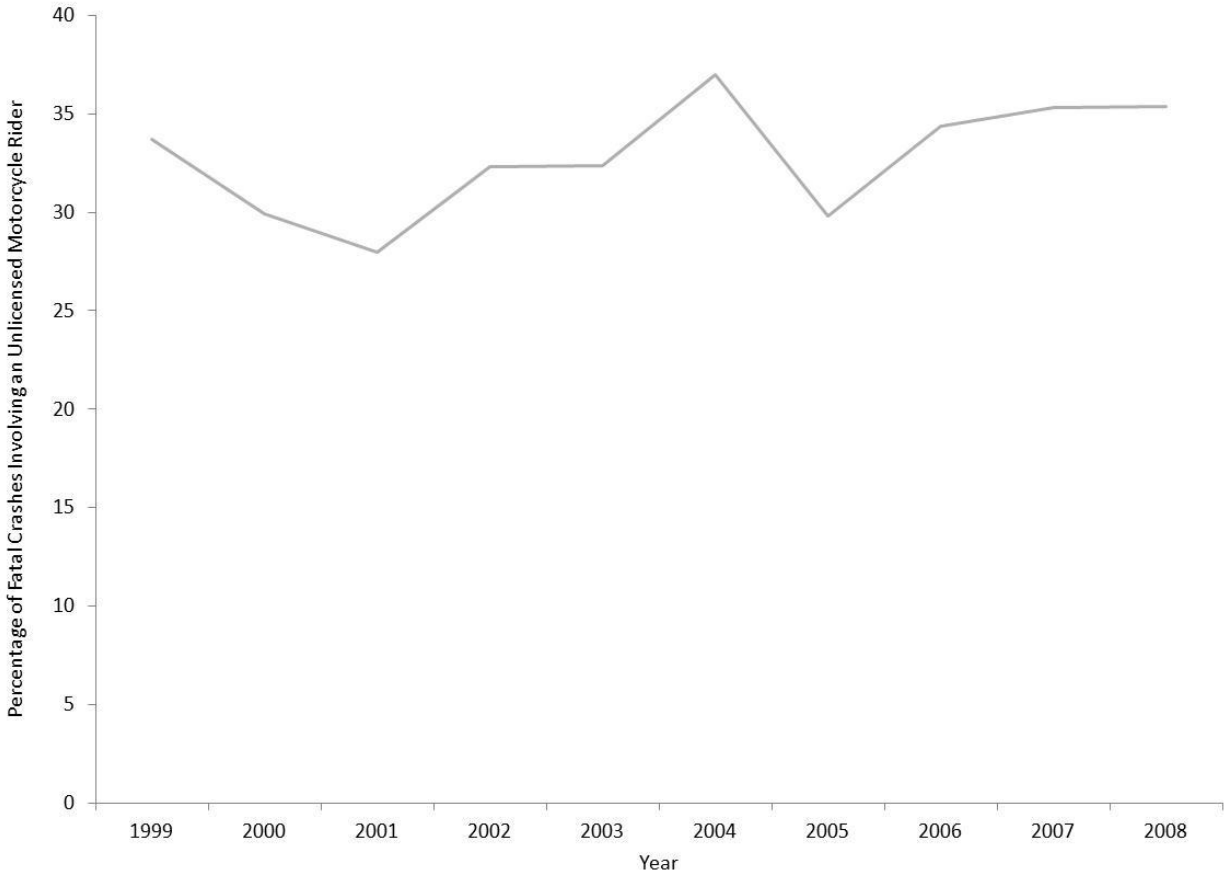


*Figure 5.* Percentage of motorcycle riders involved in fatal crashes in California who were improperly licensed at the time of the crash from 1999 through 2008. Data obtained from the Fatality Analysis Reporting System Encyclopedia at http://www-fars.nhtsa.dot.gov/Main/index.aspx. The statistics provided on the website are compiled from annual *Traffic Safety Facts* reports published by the U.S. Department of Transportation.

The percentages of motorcyclists involved in fatal crashes from 1999 to 2008 in California who were improperly licensed are shown for different age groups in Figure 6. Crash-involved riders 21 to 34 years of age were the most likely to be unlicensed, averaging nearly 39% unlicensed during this period. Improper licensure among crash-involved riders decreased with increasing rider age, though the average percentage for the oldest group (above 14%) was still high.

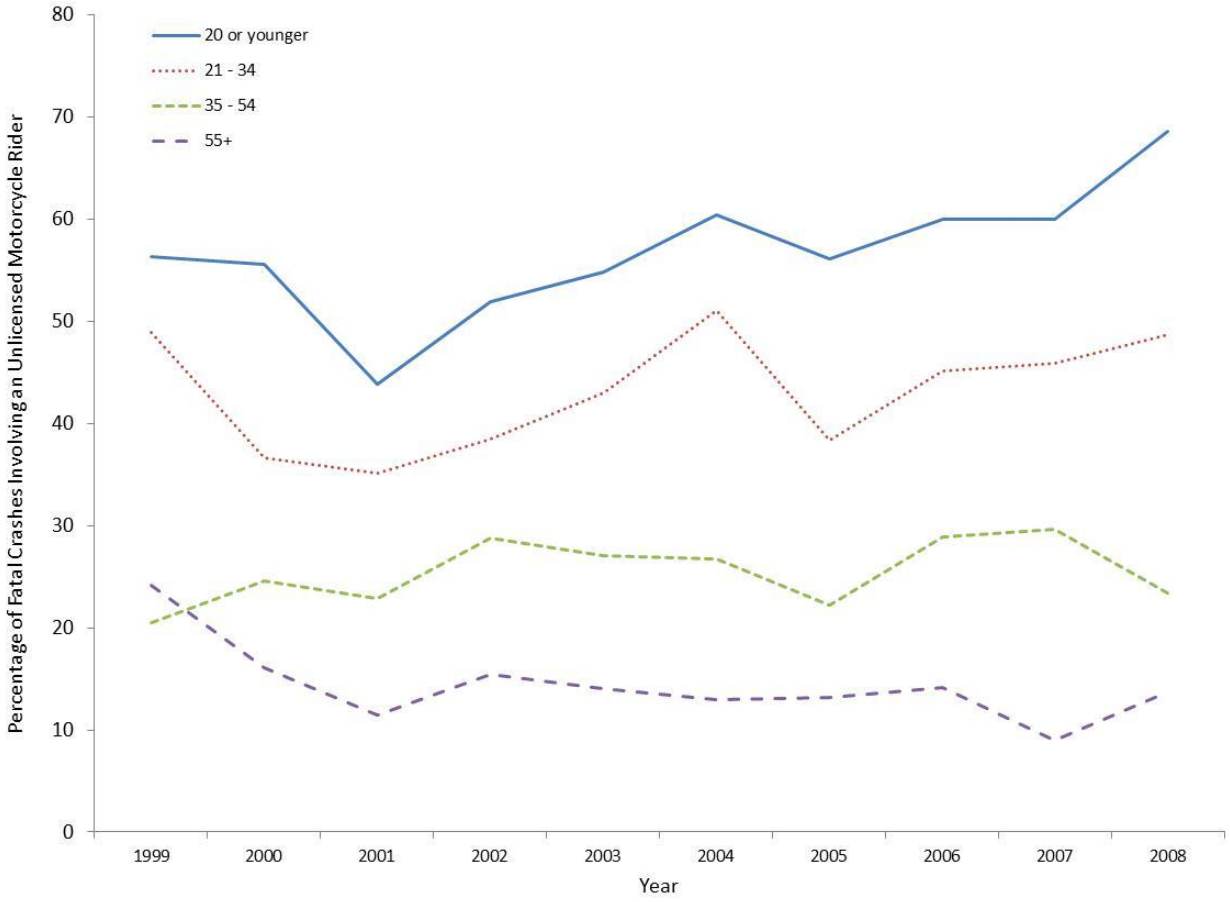


*Figure 6.* Percentages of motorcycle riders involved in fatal crashes in California who were improperly licensed at the time of the crash from 1999 through 2008 by age group. Data obtained from the Fatality Analysis Reporting System Encyclopedia at http://www-fars.nhtsa.dot.gov/Main/index.aspx. The statistics provided on the website are compiled from annual *Traffic Safety Facts* reports published by the U.S. Department of Transportation.

## Obtaining a Motorcycle License or Permit in California

Individuals who wish to become properly licensed to ride a motorcycle on public roadways in California can apply for either a Class M1 or M2 license or learner permit. The class of motorcycle license or permit issued determines the type of two-wheel vehicle that can be legally operated. For motorcycle licensing purposes, the California Department of Motor Vehicles (DMV) differentiates between four types of two-wheel vehicles: motorcycles, motor-driven cycles, motorized bicycles and mopeds, and motorized scooters. The particular classification assigned is based upon the vehicle's engine size (less than vs. ≥150 cubic centimeters [cc] of displacement), propulsion mechanism (gas vs. electric), maximum operating speed, and physical configuration.

An M1 license, endorsement, or learner permit allows the holder to ride any of the two-wheel vehicles mentioned above, while an M2 license, endorsement, or learner permit only allows the holder to ride motorized bicycles, mopeds, and scooters (less than 150cc). Operators who acquire only a Class M1 or M2 learner permit are not allowed to ride on freeways or carry passengers, and are restricted to riding during daylight hours. Individuals in possession of a Class A, B, or C license are currently legally allowed to operate three-wheeled vehicles, including motorcycles with attached sidecars, without a motorcycle license, endorsement, or learner permit.

To acquire a Class M1 or M2 learner permit in California, one must submit a license application and pass a visual acuity screening. Applicants who already have a Class A, B, or C license must pass a written test of their knowledge of rules of the road and safe driving practices specific to their current license class. If no California license of any kind is held, the applicant must also pass the knowledge test that would otherwise be required to obtain a Class C non-commercial license. All applicants must also pass a motorcycle operator knowledge test of rules of the road and safe driving practices covered in the *California Motorcycle Operator Handbook*.

In accordance with legislation enacted on January 1, 2011 (*California Vehicle Code* Section 12509.5), persons under the age of 21 must also pass a state-approved motorcycle rider safety course before they can be issued a California motorcycle license or learner permit. Such individuals must provide proof of completion of this course when submitting an application for a Class M1 or M2 license, endorsement, or learner permit. Minors must acquire and then hold a motorcycle learner permit for at least 6 months before they can apply for full motorcycle licensure. This requirement does not apply to persons age 18 or older, who can apply for and obtain full motorcycle licensure without first having to obtain a motorcycle learner permit.

To obtain a Class M1 or M2 license, the applicant must also pass or obtain a waiver for the department's motorcycle skills test. The test requires applicants to correctly identify nine specific parts of their motorcycle (starter, kill switch, throttle, etc.), and then successfully perform four separate steering maneuvers on a closed-course route. This skills test can be waived for individuals who complete the Basic Rider Course of the California Motorcyclist Safety Program administered by CHP.

The department's motorcycle rider licensing program described above is intended to increase rider competency by (1) motivating applicants to acquire at least the minimum levels of knowledge and skill necessary to pass the required tests, and (2) screening out those who are

unqualified to safely and knowledgably ride a motorcycle on public roadways as demonstrated by their failure of the required knowledge and skills tests. As mentioned previously, a large proportion (28-37%) of motorcycle riders involved in fatal crashes in California over the past decade were improperly licensed. It is conceivable that some of these crash involvements could have been prevented had the improperly licensed riders involved in these crashes possessed the minimum knowledge and skills necessary to safely operate a motorcycle as required by DMV's licensing program.

## Current Pilot Study

In an attempt to reduce crashes involving improperly licensed motorcycle riders, the department implemented a pilot program in which an official DMV contact letter was mailed to owners of currently registered motorcycles who did not have a motorcycle license, endorsement, or learner permit. The letter encouraged recipients to become properly licensed before riding a two-wheeled vehicle on public roadways, warned of the legal and financial consequences of being cited for riding a two-wheeled vehicle without the proper motorcycle license or permit, and provided information on the Basic Rider Course and how to obtain a Class M1 or M2 license or permit. This intervention was recommended by the National Highway Traffic Safety Administration (2010) to decrease unlicensed riding. A template of the DMV contact letter is provided in the Appendix.

The objectives of the pilot program were to increase motorcycle licensure and reduce crash involvements and traffic violations among those who were sent the contact letter. While the intent was to increase safety, it was possible that the program might have the opposite effect. That is, it was conceivable, for example, that the letter might increase the number of riders or amount of riding, and consequently increase the potential for more crash involvements and traffic violations. To evaluate the pilot program, the 33-month subsequent-to-mailing licensing status and 18-month subsequent-to-mailing driver records for participants sent the contact letter were compared to those for an equivalent group of participants who did not receive the letter. The study methodology and findings are presented later in this report.

## Prior Research

A similar treatment program for improperly licensed motorcycle owners was implemented and evaluated in Maryland (Braver et al., 2007). The authors reported that roughly one-fourth of all

police-reported motorcycle crashes in that state involved improperly licensed riders. The study investigators believed that a number of these crashes would be prevented if unlicensed riders received rider training, and thus sought to provide such individuals with information on how they could become trained and properly licensed.

Braver and her colleagues used Maryland Motor Vehicle Administration's licensing and registration files to obtain a sample of 8,499 improperly licensed motorcycle owners. To be included in the study, the owner had to (1) lack a motorcycle license or permit and (2) either lack a co-owner or have an unlicensed co-owner. Half of the study participants were randomly assigned to be mailed a contact letter that informed them that they had been identified as being an improperly licensed motorcycle owner. The letter also warned of the legal and financial consequences of riding a motorcycle while unlicensed, and provided information on available motorcycle training programs and the motorcycle licensing process in Maryland.

The Maryland study found a statistically significant but modest 32% increase in motorcycle licensure after 6 months associated with mailing of the contact letter, with 10.4% of those who were sent the contact letter becoming properly licensed within 6 months after the mailing compared to 7.9% of those in the control group. Still, 89.6% of improperly licensed motorcycle owners who were mailed a contact letter remained unlicensed after 6 months. The study did not evaluate whether the intervention letter was associated with changes in crashes or traffic violations.

The current study replicates the Braver et al. (2007) study by assessing the effect of an official DMV contact letter on the subsequent motorcycle licensure of improperly licensed motorcycle owners. The major differences between the studies are that the current one was conducted in California, the period following the letter mailing used to check license status was 33 rather than 6 months, and more importantly, the present study evaluated the effect of the letter on subsequent crashes and violations (which the Maryland study did not do). The specific methods used to generate the study sample and evaluate the effectiveness of the contact letter are presented below.

# Methods

## Identification of Study Participants

DMV's Information Services Division queried the department's Vehicle Registration Master File to identify and capture records for all motorcycles with a current registration in California and the department's Driver License Master File to identify and capture records for all persons with a valid motorcycle license, endorsement, or learner permit.

The resulting output file of currently registered motorcycles contained over 800,000 records, each providing information on the make and model of the motorcycle and the name and address of each recorded owner of the vehicle. Records were discarded that indicated the vehicle had more than one registered owner, was owned by military personnel or a business (e.g., sales dealership or rental company), or did not have a California driver license number recorded for the owner. Vehicles owned by a business were identified by searching the registered owner names for names of businesses (e.g., Yamaha, Safeco) or words and abbreviations that were not personalized, such as "Dealership" and "Inc." Vehicles classified by DMV as mopeds or motorized bicycles were also excluded because such vehicles do not have annual registration renewal cycles, and hence may have outdated owner information (e.g., mailing address).

The driver license numbers for the registered owners listed on the remaining motorcycle records (i.e., those *not* removed for the reasons described above) were then matched to the file containing records for all individuals with a valid motorcycle license, endorsement, or learner permit. This matching process yielded the following three groups based on the individual's motorcycle license status and whether they were found to be an owner of one of the motorcycles in the final sample of registrations: (1) properly licensed motorcycle owners, (2) licensed non-owners, and (3) improperly licensed owners. It should be noted that a licensed non-owner (as classified here) could still have owned one or more motorcycles that were not currently registered or that were excluded from the final motorcycle registration sample for one or more of the reasons described above. In addition, improperly licensed non-owners who ride motorcycles owned by someone else or that were not registered are not accounted for here because the department's databases are insufficient to identify this group.

The identified improperly licensed motorcycle owners were then screened to remove any who were deceased on the date their licensing records were initially obtained (October 28th, 2009). This yielded a final sample of 65,766 improperly licensed motorcycle owners for use in the pilot study. These individuals were randomly assigned to either be sent the official DMV contact letter (treatment group; *n* = 33,068) or to not be sent the letter (control group; *n* = 32,698) based on the terminal digit of their driver license numbers (those with an even digit being assigned to the treatment group and those with an odd digit being assigned to the control group).

## Mailing of Contact Letters

The 33,068 official DMV contact letters were mailed over a 4-day period starting on November 10th, 2009. As stated earlier, the letter notified the owner that the department was aware that they were not properly licensed to ride a two-wheel vehicle on public roadways, that doing so without the proper license or permit is a violation of *California Vehicle Code* §12500, and that being cited for a violation of this law could result in impoundment of their motorcycle and a fine exceeding $1,000.

A small number of letters (1.4%; *n* = 476) were undelivered and returned to DMV. Some individuals (0.2%; *n* = 57) responded to the letter by mail, most claiming that their actions did not warrant receiving the letter. Several of these individuals said they no longer owned the motorcycle(s) in question, only rode three-wheeled motorcycles, or owned but did not ride motorcycles, and thus were exempt from motorcycle licensing requirements. Department personnel responded to letters in which a valid reason for why the registered owner would not be required to have a motorcycle license was presented by informing the senders that no further action was required. In other cases where no valid excuse was presented, department personnel provided additional information about which class of motorcycle license was required to legally operate the registered motorcycle, how to enroll in a motorcycle training course, or simply reemphasized the original letter content. In a small number of cases, the owners claimed they already had a motorcycle license, endorsement, or learner permit; such cases were referred to the department's Driver License Issuance Unit for investigation and response. Although some letters were returned as undeliverable and others were erroneously mailed to registered owners who were not required to have a motorcycle license, the integrity of the study groups, as randomly assigned, was maintained for analysis purposes. This is sometimes called an "intent-to-treat" evaluation and is frequently used to avoid introducing selection bias.

## Data Sources

Data on the study participant's demographics, motorcycle licensing status, crash involvements, traffic violations, and other variables used in the analyses were obtained from DMV driver records. Traffic violations included incidents for which the driver was convicted, failed to appear in court, or had a moving violation dismissed as a result of attending a traffic violator school. Crash involvements and traffic violations were counted for the 2-year period before the letters were mailed and separately for the 18-month period afterwards. The starting letter mail date (November 10th, 2009) was used as the reference date for counting crashes and violations within these periods. Crash involvements and traffic violations were divided into those that were motorcycle-related (i.e., in which the subject was riding the motorcycle at the time of the incident) and those that were not motorcycle-related incidents. Total traffic violations (motorcycle-related or not) were categorized based upon whether the infraction was a major (2-point) or minor (1-point) violation.

The driver record data were extracted from the Driver License Master File on August 10th, 2012, which provided 14½ months following the end of the 18-month criterion period (May 10th, 2011) for crash and violation incidents occurring during the criterion period to be reported to DMV and added to driver records, and hence be included in the analyses. This "lag period" was intended to provide sufficient time for crashes occurring during the 18-month post-treatment period to be reported to DMV and recorded in the Driver License Master File (DRM). Historically, a 3-month lag has been more than ample for this purpose. Unfortunately, as of October 2011, CHP was over 13 months behind in reporting crashes to DMV. CHP attributed this increased reporting lag to staff shortages and furloughs of non-sworn CHP personnel.

The August 10, 2012 driver record extract date also enabled the licensing status of each subject to be determined 33 months after the mailing of the letter on November 10th, 2009 (a data-extract lag period is not necessary for licensing information because license issuance transactions are updated immediately to the DRM).

## Data Analyses

Logistic regression analysis was used to validate the method used to randomly assign study participants into the treatment (letter) or control (no-letter) groups. In this analysis, age, sex, pre-treatment driver record variables, number of non-motorcycle license endorsements (e.g.,

endorsements to transport hazardous materials or drive a passenger bus), and pre-treatment suspension/revocation status were used as predictors of group assignment. If the random assignment resulted in pre-treatment equivalency between the groups, these variables should not significantly predict group assignment and the overall fit of the prediction model should be poor.

The effect of the official DMV contact letter on 33-month post-treatment subsequent motorcycle licensure was initially evaluated using a chi-square test of independence. Logistic regression was then used to estimate the effect of the letter on the odds of obtaining proper motorcycle licensure during the follow-up period after adjusting for several potential confounders. In the logistic model, age, sex, pre-treatment driver record variables, and study group membership (treatment letter vs. no-letter control) were used to predict motorcycle license status (i.e., being properly licensed to operate a motorcycle vs. no change from pre-treatment) 33 months after the mail date of the letters. Group-by-age and group-by-sex interaction terms were also included as predictors in the model to determine whether any effect of the letter on subsequent motorcycle licensure differed as a function of owner age or sex.

Logistic regression was also used to separately evaluate the effect of the letter on 18-month subsequent total, motorcycle-related, and non-motorcycle-related crash involvements. Total crashes include those that occurred while operating any type of vehicle. For these analyses, the crash criterion measures were dichotomized to indicate whether or not a participant was involved in one or more crashes (i.e., no crash involvement vs. one or more crash involvements). Study group membership, age, sex, and pre-treatment driver record variables were again used as predictors in the models. Group-by-age and group-by-sex interaction terms were also included as predictors to determine whether any effect of the letter was different for men and women or for owners of different ages.

Likelihood ratio tests for each logistic analysis were used to assess overall model fit. Wald chi-square tests and an alpha level of .05 were used to assess the statistical significance of the individual predictors. Odds ratios were calculated to estimate the change in odds of the outcome variables associated with a one unit change in each predictor variable.

To supplement the logistic regression crash models, Kaplan-Meier and Cox Proportional Hazards survival analyses were used to model first-crash incidence rates during the 18 months subsequent to when the letters were mailed. Age, sex, pre-treatment driver record variables, and study group

membership were used as predictors in the Cox regression analyses. A group-by-time interaction term was used in each Cox regression model to test the proportional hazards assumption.

Linear regression was used to separately predict total, motorcycle-related, and non-motorcycle-related traffic violations accumulated during the 18 months subsequent to when the letters were mailed. Total traffic violations include those that occurred while operating any type of vehicle. Age, sex, pre-treatment driver record variables, study group membership, and group-by-age and group-by-sex interaction terms were again used as predictors in these models.

## Results

### Descriptive Statistics for Letter and No Letter Groups

Table 1 presents descriptive statistics for various demographic and pre- and post-treatment driver record variables for participants in the treatment (letter) and control (no letter) study groups. The pre-treatment driver record variables represent incidents that occurred during the 2 years preceding the mail date of the contact letter, whereas the post-treatment driver record variables cover the 33-month licensing and 18-month crash and conviction periods subsequent to the mailing date of the letter.

Table 1

Descriptive Statistics for the Letter and No Letter Study Groups

| Variable | Study group | |
|---|---|---|
| | Treatment (letter) *N* = 33,068 | Control (no letter) *N* = 32,698 |
| Age (mean) | 45.77 | 45.85 |
| Male (%) | 72.76 | 73.05 |
| Non-motorcycle certificates/endorsements (per 100) | 14.23 | 14.15 |
| 2-year pre-treatment driver record (per 100) | | |
| Total crash involvements | 10.65 | 10.79 |
| Total violations | 49.99 | 49.32 |
| Two-point violations | 1.95 | 1.98 |
| One-point violations | 34.36 | 33.90 |
| Motorcycle crash involvements | 0.81 | 0.81 |
| Motorcycle violations | 2.08 | 2.01 |
| Suspended or revoked license | 8.32 | 8.15 |
| 18-month post-treatment driver record (per 100) | | |
| Total crash involvements | 6.85 | 6.66 |
| Total violations | 33.74 | 33.32 |
| Two-point violations | 1.33 | 1.26 |
| One-point violations | 21.83 | 21.55 |
| Non-motorcycle crash involvements | 6.29 | 6.03 |
| Motorcycle crash involvements | 0.56 | 0.64 |
| Motorcycle violations | 1.44 | 1.43 |
| 33-month post-treatment motorcycle license/permit (%) | 14.46 | 10.40 |

The groups appear to be similar on the demographic and pre-treatment driver record variables, as would be expected if the random assignment was successful. Also shown is that the percentage of participants who received the official DMV contact letter and who subsequently obtained a motorcycle license or learner permit was 14.46% compared to 10.40% among those who did not receive the contact letter.

## Assessment of Study Group Equivalency at Random Assignment

To evaluate whether the method used to assign participants into the treatment (letter) and control (no letter) study groups produced equivalent pre-treatment groups with respect to age, sex, number of non-motorcycle endorsements/certificates, and prior driver record, these variables were entered into a logistic regression analysis predicting study group assignment (treatment vs. control). The results are presented in Table 2.

Table 2

Summary of Logistic Regression Predicting Study Group Assignment

| Predictor | Regression coefficient | Standard error | Wald $\chi^2$ | *p* | Odds ratio | 95% confidence interval |
|---|---|---|---|---|---|---|
| Intercept | 0.0332 | 0.0314 | 1.12 | .2902 | — | — |
| Age | -0.0003 | 0.0006 | 0.24 | .6277 | 1.00 | 1.00–1.00 |
| Sex | -0.0172 | 0.0180 | 0.92 | .3378 | 0.98 | 0.95–1.02 |
| Certificates/endorsements | 0.0054 | 0.0145 | 0.14 | .7119 | 1.00 | 0.98–1.03 |
| Prior suspension/revocation | 0.0278 | 0.0315 | 0.78 | .3769 | 1.03 | 0.97–1.09 |
| Prior non-motorcycle crashes | -0.0153 | 0.0241 | 0.41 | .5245 | 0.99 | 0.94–1.03 |
| Prior motorcycle crashes | -0.0023 | 0.0867 | 0.00 | .9788 | 1.00 | 0.84–1.18 |
| Prior two-point violations | -0.0345 | 0.0584 | 0.35 | .5540 | 0.97 | 0.86–1.08 |
| Prior one-point violations | 0.0087 | 0.0120 | 0.52 | .4699 | 1.01 | 0.99–1.03 |
| Prior motorcycle violations | 0.0187 | 0.0505 | 0.14 | .7105 | 1.02 | 0.92–1.13 |

*Note.* Overall model fit was not statistically significant, $\chi^2(9, N = 65{,}766) = 3.46$, $p = .9434$. Coding: Sex 0 = women, 1 = men; Study Group 0 = control, 1 = treatment.

The fit of the model predicting study group assignment was non-significant ($p = .9434$), indicating that the predictors, as a set, did not reliably distinguish between drivers in the two study groups. In addition, none of the individual predictors were related to group assignment ($p$s > .05). These results indicate that the study group assignment was indeed random and

resulted in equivalent pre-treatment groups with respect to demographic, licensure, and driver history variables.

## Effect of the Contact Letter on Subsequent Motorcycle Licensure

Results of a chi-square test of independence indicated that 33-month subsequent-to-mailing motorcycle licensure differed between the study groups, with participants who received the official DMV contact letter being 39% more likely to be properly licensed to operate a motorcycle (14.46%) than those who did not receive the letter (10.40%), $\chi^2(1, N = 65{,}766) = 249.89$, $p = .0001$. However, the majority (85.54%) of motorcycle owners who received the letter still remained improperly licensed to operate a motorcycle 33 months later.

To further evaluate the effect of the letter on motorcycle licensure, age, sex, pre-treatment driver record variables, and study group were used as predictors in a logistic regression model predicting 33-month subsequent-to-mailing motorcycle licensure. The intent of this analysis was to determine whether the letter was still significantly associated with subsequent motorcycle licensure after adjusting for any nominal differences between the study groups on the other predictors.

The logistic regression results presented in Table 3 indicate that the model significantly predicted subsequent motorcycle licensure ($p = .0001$). Age, sex, prior one-point traffic violations, motorcycle-related traffic violations, study group, and the group-by-age (continuous) interaction were all statistically significant predictors of subsequent motorcycle licensure ($p$s $< .05$).

The significant group-by-age interaction parameter indicates that the effect of the letter on subsequent motorcycle licensure varied according to driver age. To explore this variation in the effect of the letter according to the age of the owner, the age variable was categorized into the following age groups: 19 and younger ($n = 362$), 20 to 34 ($n = 13{,}544$), 35 to 54 ($n = 35{,}767$), and 55 and older ($n = 16{,}093$). Separate odds ratios reflecting the effect of the contact letter on subsequent motorcycle licensure were then calculated for each age group. The results, presented in Table 4, indicate that the letter did not significantly affect motorcycle licensure status for the youngest group (under 20 years), though it did significantly increase the odds of subsequent motorcycle licensure for owners aged 20 to 34 (21%), 35 to 54 (47%), and 55 and older (96%).

Table 3

Summary of Logistic Regression Predicting 33-Month Subsequent Motorcycle Licensure

| Predictor | Regression coefficient | Standard error | Wald $\chi^2$ | *p* | Odds ratio | 95% confidence interval |
|---|---|---|---|---|---|---|
| Intercept | -2.2162 | 0.0733 | 915.09 | .0001* | — | — |
| Age | -0.0258 | 0.0015 | 313.37 | .0001* | — | — |
| Sex | 1.4305 | 0.0392 | 1334.82 | .0001* | 4.18 | 3.87–4.51 |
| Prior non-motorcycle crashes | 0.0481 | 0.0359 | 1.80 | .1803 | 1.05 | 0.98–1.13 |
| Prior motorcycle crashes | 0.1767 | 0.1120 | 2.49 | .1148 | 1.19 | 0.96–1.49 |
| Prior two-point violations | 0.0097 | 0.0731 | 0.02 | .8945 | 1.01 | 0.88–1.17 |
| Prior one-point violations | 0.0417 | 0.0169 | 6.11 | .0135* | 1.04 | 1.01–1.08 |
| Prior motorcycle violations | 0.3361 | 0.0590 | 32.42 | .0001* | 1.40 | 1.25–1.57 |
| Group | -0.1730 | 0.0861 | 4.04 | .0445* | — | — |
| Group x age | 0.0129 | 0.0019 | 46.28 | .0001* | — | — |

*Note*. $\chi^2(9, N = 65{,}766) = 2546.75$, $p = .0001$. Coding: Sex 0 = women, 1 = men; Study Group 0 = control, 1 = treatment; Licensure Status 0 = unlicensed, 1 = license or permit. A group-by-sex interaction term was included in the original model, but was removed due to non-significant findings ($p > .05$).
*$p < .05$.

Table 4

Odds Ratios Illustrating how the Effect of the Contact Letter on 33-Month Subsequent Motorcycle Licensure Differed across Owner Age Groups

| Age group | Wald $\chi^2$ | Standard error | *p* | Odds ratio | 95% confidence interval |
|---|---|---|---|---|---|
| 19 or younger | 0.02 | 0.2694 | .8942 | 0.96 | 0.56–1.67 |
| 20–34 | 14.78 | 0.0604 | .0001* | 1.21 | 1.10–1.34 |
| 35–54 | 142.59 | 0.0475 | .0001* | 1.47 | 1.38–1.57 |
| 55 or older | 141.46 | 0.1108 | .0001* | 1.96 | 1.75–2.19 |

*$p < .05$.

## Effect of the Contact Letter on Subsequent Crash Involvements

To evaluate the effect of the official DMV contact letter on subsequent crash involvements, age, sex, pre-treatment driver record variables, and study group were used in three separate logistic

regression analyses predicting 18-month subsequent total, motorcycle-related, and non-motorcycle-related crash involvements.

The logistic regression results for total crashes presented in Table 5 indicate that the model significantly distinguished between participants who were subsequently involved in one or more crashes and those who were crash-free ($p = .0001$). Age, sex, and prior non-motorcycle crashes, motorcycle crashes, and one-point violations were statistically significant predictors of crash involvement ($ps < .05$), but the effect of the treatment letter was not statistically significant ($ps > .05$).

Table 5

Summary of Logistic Regression Predicting 18-Month Subsequent Total Crash Involvement

| Predictor | Regression coefficient | Standard error | Wald $\chi^2$ | *p* | Odds ratio | 95% confidence interval |
|---|---|---|---|---|---|---|
| Intercept | -2.6823 | 0.0665 | 1626.49 | .0001* | — | — |
| Age | -0.0069 | 0.0013 | 30.40 | .0001* | 0.93 | 0.99–1.00 |
| Sex | 0.1985 | 0.0382 | 26.94 | .0001* | 1.22 | 1.13–1.32 |
| Prior non-motorcycle crashes | 0.4796 | 0.0388 | 152.74 | .0001* | 1.62 | 1.50–1.74 |
| Prior motorcycle crashes | 0.5703 | 0.1320 | 18.67 | .0001* | 1.77 | 1.37–2.29 |
| Prior two-point violations | -0.1570 | 0.1068 | 2.16 | .1417 | 0.86 | 0.69–1.05 |
| Prior one-point violations | 0.1839 | 0.0207 | 78.60 | .0001* | 1.20 | 1.15–1.25 |
| Prior motorcycle violations | 0.1482 | 0.0791 | 3.51 | .0609 | 1.16 | 0.99–1.35 |
| Group | 0.0316 | 0.0321 | 0.97 | .3246 | 1.03 | 0.97–1.10 |

*Note*. $\chi^2(8, N = 65{,}766) = 355.41$, $p = .0001$. Coding: Sex 0 = women, 1 = men; Study Group 0 = control, 1 = treatment. Group-by-age and group-by-sex interaction terms were included in the original model, but were removed due to non-significant findings ($p > .05$).
*$p < .05$.

Table 6 presents the results of the logistic regression predicting motorcycle-related crash involvement. The model significantly predicted motorcycle crash involvement ($p = .0001$), with age, sex, and pre-treatment motorcycle crashes, one-point violations, and motorcycle violations all being significant predictors ($ps < .05$). Again, the effect of the treatment letter was not statistically significant ($ps > .05$).

Table 6

Summary of Logistic Regression Predicting 18-Month Subsequent Motorcycle-Related Crash Involvement

| Predictor | Regression coefficient | Standard error | Wald $\chi^2$ | *p* | Odds ratio | 95% confidence interval |
|---|---|---|---|---|---|---|
| Intercept | -6.2201 | 0.2914 | 455.68 | .0001* | — | — |
| Age | -0.0153 | 0.0041 | 14.29 | .0002* | 0.96 | 0.98–0.99 |
| Sex | 1.9305 | 0.2363 | 66.74 | .0001* | 6.89 | 4.34–10.95 |
| Prior non-motorcycle crashes | 0.1882 | 0.1346 | 1.95 | .1622 | 1.21 | 0.93–1.57 |
| Prior motorcycle crashes | 0.9871 | 0.2706 | 13.31 | .0003* | 2.68 | 1.58–4.56 |
| Prior two-point violations | 0.1415 | 0.2505 | 0.32 | .5722 | 1.15 | 0.71–1.88 |
| Prior one-point violations | 0.1722 | 0.0588 | 8.58 | .0034* | 1.19 | 1.06–1.33 |
| Prior motorcycle violations | 0.7341 | 0.1287 | 32.54 | .0001* | 2.08 | 1.62–2.68 |
| Group | -0.1152 | 0.1025 | 1.26 | .2609 | 0.89 | 0.73–1.09 |

*Note*. $\chi^2(8, N = 65{,}766) = 227.30$, $p = .0001$. Coding: Sex 0 = women, 1 = men; Study Group 0 = control, 1 = treatment. Group-by-age and group-by-sex interaction terms were included in the original model, but were removed due to non-significant findings ($p > .05$).
*$p < .05$.

Table 7 presents the results for the logistic regression model predicting non-motorcycle-related crash involvement. The model significantly predicted non-motorcycle-related crash involvement ($p = .0001$), with age, sex, and pre-treatment non-motorcycle crashes, motorcycle crashes, and one-point violations all serving as significant predictors ($p$s < .05). Once again, the effect of the treatment letter was not statistically significant ($p$s > .05).

Table 7

Summary of Logistic Regression Predicting 18-Month Subsequent Non-Motorcycle-Related Crash Involvement

| Predictor | Regression coefficient | Standard error | Wald $\chi^2$ | *p* | Odds ratio | 95% confidence interval |
|---|---|---|---|---|---|---|
| Intercept | -2.7465 | 0.0689 | 1588.82 | .0001* | — | — |
| Age | -0.0061 | 0.0013 | 21.64 | .0001* | 0.99 | 0.99–1.00 |
| Sex | 0.1041 | 0.0390 | 7.12 | .0076* | 1.11 | 1.03–1.20 |
| Prior non-motorcycle crashes | 0.5004 | 0.0399 | 156.95 | .0001* | 1.65 | 1.53–1.78 |
| Prior motorcycle crashes | 0.4867 | 0.1455 | 11.18 | .0008* | 1.63 | 1.22–2.16 |
| Prior two-point violations | -0.2097 | 0.1162 | 3.26 | .0712 | 0.81 | 0.65–1.02 |
| Prior one-point violations | 0.1874 | 0.0217 | 74.64 | .0001* | 1.21 | 1.16–1.26 |
| Prior motorcycle violations | -0.1037 | 0.0977 | 1.13 | .2885 | 0.90 | 0.74–1.09 |
| Group | 0.0431 | 0.0335 | 1.66 | .1973 | 1.04 | 0.98–1.12 |

*Note*. $\chi^2(8, N = 65{,}766) = 288.48$, $p = .0001$. Coding: Sex 0 = women, 1 = men; Study Group 0 = control, 1 = treatment. Group-by-age and group-by-sex interaction terms were included in the original analysis, but were removed due to non-significant findings ($p > .05$).
*$p < .05$.

## Effect of the Contact Letter on Time to First Subsequent Crash

Kaplan-Meier survival plots and log-rank tests were used to compare the letter and no-letter groups on time-to-first crash in any type of vehicle (total first-crash incidence rates). The log-rank chi square value was not statistically significant ($p$ =.2795), indicating that improperly licensed owners who received the DMV letter did not have different total first-crash incidence rates compared to those who did not receive the letter ($p < .05$). The nearly-identical Kaplan-Meier survival curves shown in Figure 7 are consistent with this finding. The fit of the Cox proportional hazards model, which used age, sex, pre-treatment diving record, and study group membership to predict total first-crash incidence rates, was statistically significant ($p = .0001$). The results presented in Table 8 indicate that age, sex, and pre-treatment non-motorcycle crashes, motorcycle crashes, and one-point violations were all significant predictors of total first-crash incidence rates ($p$s < .05). However, the findings do not indicate a significant effect of the treatment letter on total first-crash incidence rates ($p > .05$).

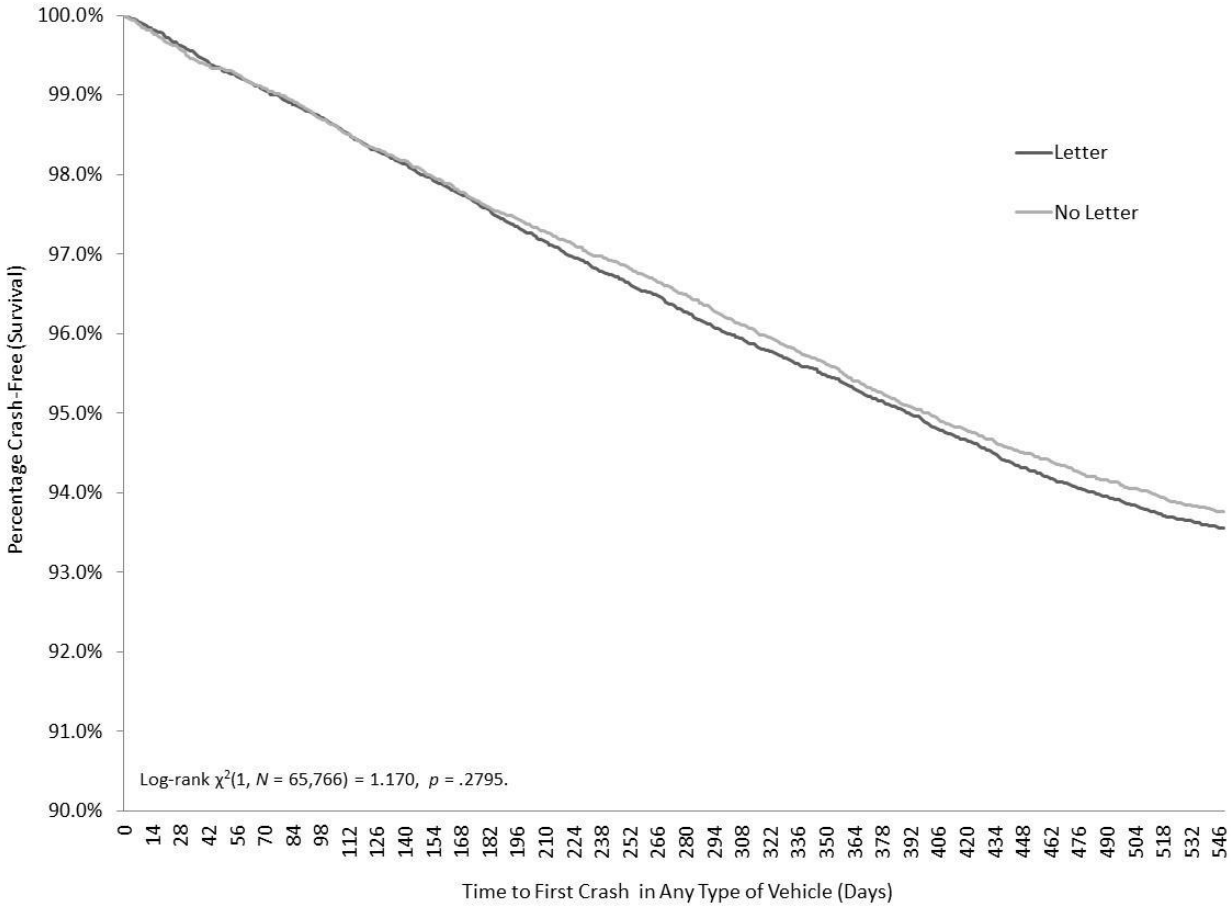


*Figure 7*. Kaplan-Meier survival distributions of total first-crash incidence rates in any type of vehicle by study group.

Table 8

Results of the Cox Proportional Hazards Model Predicting Time to First Crash in any Type of Vehicle during the Subsequent 18-Month Time Period

| Predictor | Regression coefficient | Standard error | $\chi^2$ | *p* |
|---|---|---|---|---|
| Age | -0.0007 | 0.0012 | 29.60 | .0001* |
| Sex | 0.1944 | 0.0371 | 27.51 | .0001* |
| Prior non-motorcycle crashes | 0.4534 | 0.0361 | 157.97 | .0001* |
| Prior motorcycle crashes | 0.5289 | 0.1234 | 18.41 | .0001* |
| Prior two-point violations | -0.1486 | 0.1021 | 2.12 | .1455 |
| Prior one-point violations | 0.1720 | 0.0194 | 78.80 | .0001* |
| Prior motorcycle violations | 0.1392 | 0.0715 | 3.79 | .0516 |
| Group | 0.0327 | 0.0310 | 1.11 | .2913 |

*Note.* $\chi^2$ (8, $N$ = 65,766) = 352.18, $p$ = .0001. Coding: Sex 0 = women, 1 = men; Study Group 0 = control, 1 = treatment. The group-by-time interaction term, which is not shown here, was not statistically significant ($p > .05$), indicating that the proportional hazards assumption of the Cox regression was met.
*$p < .05$.

Kaplan-Meier log-rank tests and survival plots were then used to compare the letter and no-letter groups on time-to-first motorcycle-related crash (motorcycle-related first-crash incidence rates). The log-rank chi-square for this outcome was not statistically significant ($p$ = .3273), indicating no significant difference between owners who received the letter and those who did not on motorcycle-related first-crash incidence rates ($p < .05$). Furthermore, the Kaplan-Meier curves plotted in Figure 8 are virtually identical, consistent with there being no effect of the treatment letter on motorcycle-related first-crash incidence rates. Note that scaling for this figure begins at 99.0%.

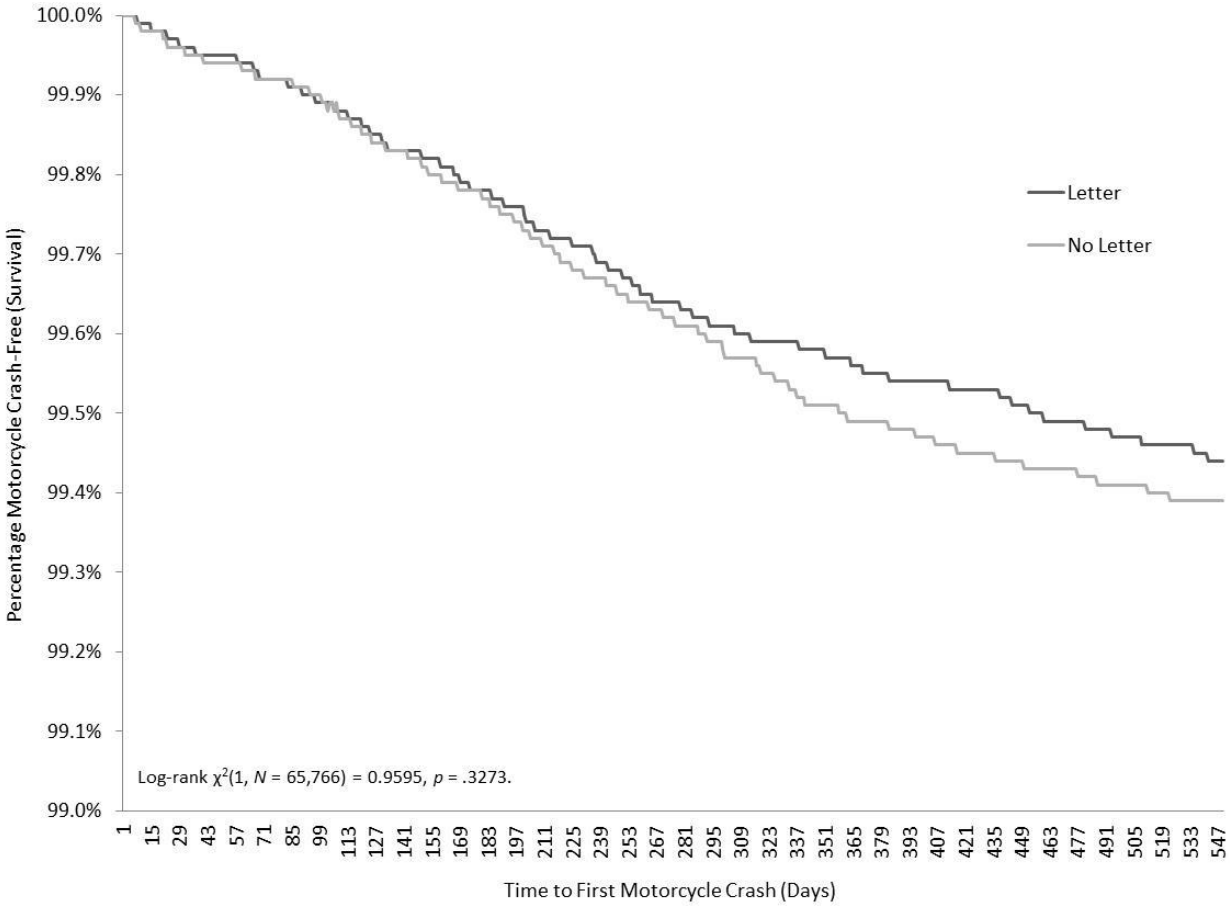


*Figure 8*. Kaplan-Meier survival distributions of motorcycle-related first-crash incidence rates by study group.

The results of the Cox proportional hazards analysis comparing the letter and no-letter groups on motorcycle-related first-crash incidence rates are presented in Table 9. The fit of this model is again significant ($p$ = .0001), with age, sex, and pre-treatment one-point violations and motorcycle crashes and violations all serving as significant predictors of motorcycle-related first-crash incidence rates ($p$s < .05). The findings indicate no significant effect of the treatment letter on motorcycle-related first-crash incidence rates ($p$ > .05).

Table 9

Results of the Cox Proportional Hazards Model Predicting Time to First Motorcycle Crash during the Subsequent 18-Month Time Period

| Predictor | Regression coefficient | Standard error | $\chi^2$ | *p* |
|---|---|---|---|---|
| Age | -0.0154 | 0.0040 | 14.58 | .0001* |
| Sex | 1.9275 | 0.2362 | 66.61 | .0001* |
| Prior non-motorcycle crashes | 0.1660 | 0.1344 | 1.53 | .2167 |
| Prior motorcycle crashes | 1.0218 | 0.2611 | 15.32 | .0001* |
| Prior two-point violations | 0.1096 | 0.2420 | 0.21 | .6508 |
| Prior one-point violations | 0.1694 | 0.0578 | 8.60 | .0034* |
| Prior motorcycle violations | 0.6392 | 0.1018 | 39.47 | .0001* |
| Group | -0.1038 | 0.1021 | 1.03 | .3094 |

*Note.* $\chi^2$ (8, *N* = 65,766) = 222.79, *p* = .0001. Coding: Sex 0 = women, 1 = men; Study Group 0 = control, 1 = treatment. The group-by-time interaction term, which is not shown here, was not statistically significant (*p* > .05), indicating that the proportional hazards assumption of the Cox regression was met.
*$p < .05$.

## Effect of the Contact Letter on Subsequent Traffic Violations

The effect of the official DMV contact letter on subsequent traffic violations was assessed by using age, sex, pre-treatment driver record variables, and study group (letter vs. no letter) to predict, in three separate linear regression analyses, 18-month subsequent total, motorcycle-related, and non-motorcycle-related traffic violations. Tests of linearity, normality, and homoscedasticity did not suggest that there were violations of these assumptions for any of the linear regression models.

The results of the linear regression model predicting total subsequent traffic violations presented in Table 10 indicate that the model accounted for a statistically significant percentage (7%) of the variance in total subsequent traffic violations (*p* = .0001). The significant predictors included age, sex, and pre-treatment non-motorcycle crashes, one- and two-point violations, and motorcycle violations (*p*s < .05), but the effect of the treatment letter was not significant (*p*s > .05).

Table 10

Summary of Linear Regression Model Predicting 18-Month Subsequent Total Traffic Violations

| Predictor | Regression coefficient | Standard error | *t* | *p* |
|---|---|---|---|---|
| Intercept | 0.4754 | 0.0106 | 44.70 | .0001* |
| Age | -0.0069 | 0.0002 | -34.28 | .0001* |
| Sex | 0.1367 | 0.0059 | 23.26 | .0001* |
| Prior non-motorcycle crashes | 0.0740 | 0.0080 | 9.30 | .0001* |
| Prior motorcycle crashes | 0.0193 | 0.0287 | 0.67 | .5012 |
| Prior two-point violations | 0.0380 | 0.0178 | 2.13 | .0032* |
| Prior one-point violations | 0.1866 | 0.0040 | 47.16 | .0001* |
| Prior motorcycle violations | 0.0968 | 0.0167 | 5.82 | .0001* |
| Group | 0.0033 | 0.0052 | 0.63 | .5271 |

*Note*. $R^2$ = .07; $F(8, 65{,}758) = 644.58$, $p$ = .0001. Coding: Sex 0 = women, 1 = men; Study Group 0 = control, 1 = treatment. Group-by-age and group-by-sex interaction terms were included in the original model, but were removed due to non-significant findings ($p > .05$).
*$p < .05$.

Table 11 presents the linear regression model results for predicting motorcycle-related traffic violations. The fit of the overall model was statistically significant ($p$ = .0001), but accounted for only 1% of the variability in motorcycle-related traffic violations. Age, sex, and pre-treatment motorcycle crashes, one-point violations, and motorcycle violations were all significant individual predictors ($p$s < .05). The effect of the treatment letter was not statistically significant ($p$s > .05).

Table 11

Summary of Linear Regression Model Predicting
18-Month Subsequent Motorcycle-Related Traffic Violations

| Predictor | Regression coefficient | Standard error | *t* | *p* |
|---|---|---|---|---|
| Intercept | 0.0228 | 0.0021 | 10.90 | .0001* |
| Age | -0.0005 | 0.0000 | -12.99 | .0001* |
| Sex | 0.0169 | 0.0012 | 14.63 | .0001* |
| Prior non-motorcycle crashes | -0.0015 | 0.0016 | -0.98 | .3255 |
| Prior motorcycle crashes | -0.0143 | 0.0056 | -2.54 | .0110* |
| Prior two-point violations | 0.0052 | 0.0035 | 1.48 | .1398 |
| Prior one-point violations | 0.0049 | 0.0008 | 6.30 | .0001* |
| Prior motorcycle violations | 0.0601 | 0.0033 | 18.36 | .0001* |
| Group | 0.0000 | 0.0010 | -0.01 | .9953 |

*Note*. $R^2$ = .01; $F(8, 65{,}758) = 115.68$, $p$ = .0001. Coding: Sex 0 = women, 1 = men; Study Group 0 = control, 1 = treatment. Group-by-age and group-by-sex interaction terms were included in the original model, but were removed due to non-significant findings ($p > .05$).
*$p < .05$.

The results of the linear regression model predicting non-motorcycle-related traffic violations are shown in Table 12. The fit of this model is highly significant ($p$ = .0001), accounting for 7% of the variability in non-motorcycle-related traffic violations. Although age, sex, and pre-treatment non-motorcycle crashes, one-point violations, and motorcycle violations were significant predictors ($p$s < .05), the effect of the treatment letter was not statistically significant ($p$s > .05).

Table 12

Summary of Linear Regression Model

Predicting 18-Month Subsequent Non-Motorcycle-Related Traffic Violations

| Predictor | Regression coefficient | Standard error | *t* | *p* |
|---|---|---|---|---|
| Intercept | 0.4526 | 0.0104 | 43.66 | .0001* |
| Age | -0.0064 | 0.0002 | -32.56 | .0001* |
| Sex | 0.1198 | 0.0057 | 20.91 | .0001* |
| Prior non-motorcycle crashes | 0.0756 | 0.0078 | 9.74 | .0001* |
| Prior motorcycle crashes | 0.0336 | 0.0279 | 1.20 | .2288 |
| Prior two-point violations | 0.0328 | 0.0174 | 1.89 | .0590 |
| Prior one-point violations | 0.1817 | 0.0039 | 47.12 | .0001* |
| Prior motorcycle violations | 0.0368 | 0.0162 | 2.27 | .0235* |
| Group | 0.0033 | 0.0050 | 0.65 | .5156 |

*Note*. $R^2 = .07$; $F(8, 65{,}758) = 597.03$, $p = .0001$. Coding: Sex 0 = women, 1 = men; Study Group 0 = control, 1 = treatment. Group-by-age and group-by-sex interaction terms were included in the original model, but were removed due to non-significant findings ($p > .05$).
*$p < .05$.

# Discussion

## General Discussion of Findings

Thirty-three months after the contact letters were mailed, the percentage of motorcycle owners holding a motorcycle license or learner permit was significantly higher for participants who were mailed the contact letter (14.5%) than for participants who were not (10.4%). This 39% increase in subsequent motorcycle licensure associated with the contact letter is similar to the 32% increase in motorcycle licensure found by Braver et al. (2007). Nonetheless, the majority (85.5%) of motorcycle owners in the present study who received the letter remained improperly licensed to operate a motorcycle 33 months later.

The increases in motorcycle licensure associated with the contact letter were moderated significantly by owner age (see Table 4), consistent with the results obtained by Braver et al. (2007). For those aged 19 or younger, the probability of becoming licensed was not significantly different between the letter and no-letter conditions. Significant differences emerged however when comparing the odds of motorcycle licensure for owners age 20 or older. For participants aged 20 to 34, the odds of becoming licensed were 21% higher for those who were mailed the contact letter compared to those who were not. Similarly, the odds of licensure for owners 35 to 54 were higher (47%) for the letter condition compared to the no-letter condition. This effect is further strengthened when evaluating motorcycle licensure for the oldest comparison group; more specifically, owners aged 55 years or older who were mailed the contact letter were 96% more likely to become licensed compared to owners in that age group who were not.

It was of concern that increasing motorcycle licensure as a result of the letter might lead to an increase in motorcycle riding (i.e., exposure) and hence an *increase* in crash and/or violation rates. However, the lack of a significant effect of the letter on these rates suggests that while receiving the letter may have increased the likelihood of an owner becoming licensed, it did not appear to impact the crash or violation risk of those owners compared to individuals to whom the letter was not sent. Whether or not the letter affected riding exposure or led to a change in the competency of the treated motorcyclists, or both, is unknown, given that neither exposure nor competency were measured in the present study.

Two strengths of this study compared to that completed prior by Braver et al. (2007) are the longer period of follow-up (33 months vs. 6 months) and the fact that crash and violation rates were also compared between the groups. The fact that no increases in crashes or violations were found between the study groups in the present study suggests that the increases in motorcycle licensure among the owners were gained without negative traffic safety consequences. This suggests at least three possibilities. The first is that the contact letter resulted in increased legal licensure among the owners who were already riding. The second is that it resulted in increased legal licensure among the owners who were not riding and who continued not riding. A third is that receiving the letter convinced some owners who were riding illegally to stop doing so, or perhaps to ride less often or more carefully. Whether any of these possibilities occurred is unknown, but the contact letter nonetheless appears to have increased licensure among unlicensed owners without affecting their risk of crash involvement (Kraus et al., 1991). The findings suggest that the contact letter did not entice owners who were not riding previously to begin riding.

The significant age-by-treatment interaction suggests that future motorcycle licensing interventions, such as the treatment used here, may be more effective catalysts for change if they target specific groups of riders. For instance, this study showed that while the intervention was successful in increasing licensure for owners over the age of 20, it had no impact on motorcycle licensure rates of younger owners. One way to better understand this particular result would be to obtain and compare descriptive data and pre- and post-intervention crash and violation rates for younger owners who obtained licensure to those for owners who did not. This would help to establish a profile of the target intractable population (i.e., unlicensed, young owners) and provide guidance for the development of future interventions that might better serve this particular group. It should be mentioned however that the number of unlicensed owners under the age of 20 in the present study represented a very small proportion (< 1%) of the total sample compared to the other age classifications.

Aside from age-related differences in licensure rates, post-hoc analyses also revealed that 30% of the owners who remained unlicensed (across both study groups) by study's end were women. This finding seems rather anomalous given that women comprise only 11% of licensed motorcyclists in California (DMV, 2008–2012), but an apparent overrepresentation of women among owners who remained unlicensed was also noted by Braver et al. (2007). The fact that the percentage of unlicensed women owners is almost three times the percentage of licensed women motorcyclists in the state suggests that the likelihood of not legally riding a motorcycle

one owns is more likely among women than among men. One possible explanation for this, if it is true, is that men may sometimes register their motorcycles in the names of women confederates (e.g., wives, mothers, or girlfriends) to lower their insurance rates (particularly if the men are under age 25, and hence subject to higher insurance rates), or for some other reasons that are advantageous to them.

## Cost-Benefit of Treatment Letter

Creating and sending the letter to the 33,068 improperly licensed motorcycle owners in the treatment group cost a total of $31,705. The excess proportion of these owners who became properly licensed relative to the comparison group who did not receive the letter was 0.0406 (0.1446 – 0.1040 = 0.0406), which amounted to 1,384 additional motorcycle licensees in the treated group. Therefore, the cost of the treatment letter per additional properly-licensed owner was $23.89. The department collects a $24 fee for each motorcycle endorsement application, but this fee is not sufficient to cover the $25.92 cost to the department to test the knowledge and skills of motorcycle endorsement applicants, resulting in a net unit cost of $1.92 to the department for each completed endorsement. Adding this net cost of the endorsement to the cost of the treatment letter per additional licensed owner results in a total net cost of $25.81 per additional properly-licensed owner. Given that there was no net change in crash or traffic violation rates, any non-monetary benefit of the letter appears to be solely in bringing additional previously unlicensed owners into legal riding status.

## Overall Conclusion and Recommendation

The contact letter increased the number of previously unlicensed owners who became legal motorcycle operators without increasing their crash or traffic violation rates, but at a total net cost of $25.81 per additional owner who became properly licensed as a result of sending the letters. While the letter treatment significantly increased the motorcycle licensure rate, the overwhelming majority of treated owners in the present study (85.5%) remained improperly licensed to operate two-wheeled vehicles on public roadways, which is consistent with the results from a similar study in Maryland (Braver et al., 2007). Given the relatively low cost of treatment, the increase in motorcycle licensure associated with the letter, and the traffic-safety neutral outcomes, it is recommended that future use of a contact letter for improperly licensed owners be considered if the value of bringing owners into legal licensing status is deemed to be worth the

cost of treatment. Future letters may be more effective if they are specifically tailored to the demographic characteristics (e.g., age and sex) of the unlicensed owners.

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# Appendix

## Template of Contact Letter Used for Treated Owners

STATE OF CALIFORNIA— BUSINESS, TRANSPORTATION AND HOUSING AGENCY ARNOLD SCHWARZENEGGER, Governor

DEPARTMENT OF MOTOR VEHICLES
LICENSING OPERATIONS DIVISION
P.O. BOX 932345
SACRAMENTO, CA 94232-3450

12/17/2009

«RO_NAME»
«RO_ADDR2»
«RO_ADDR3»
«RO_ADDR4»
«RO_CITY», «RO_STATE» «RO_ZIP»

MSH_196

| Year | Make | VIN |
|---|---|---|
| «YEAR_M | «MAKE1 | «VIN1» |
| «YEAR_M | «MAKE2 | «VIN2» |
| «YEAR_M | «MAKE3 | «VIN3» |
| «YEAR_M | «MAKE4 | «VIN4» |
| «YEAR_M | «MAKE5 | «VIN5» |
| «YEAR_M | «MAKE6 | «VIN6» |
| «YEAR_M | «MAKE7 | «VIN7» |
| «YEAR_M | «MAKE8 | «VIN8» |

Our records show that you are the registered owner of the motorcycles listed above, but that you are not properly licensed to operate two-wheeled vehicles. Operating a two-wheeled vehicle on public roads without a valid motorcycle license, endorsement, or permit is a violation of *California Vehicle Code* §12500. Three-wheeled vehicles are exempt from this requirement. If you are cited by law enforcement for violating this law, your vehicle may be impounded and you may have to pay up to $1,006 in fines and court fees.

You may apply for a motorcycle license, endorsement, or permit at any DMV office. You will need to pass tests of your vision, knowledge, and riding skills. More information on the licensing requirements is contained in the *California Motorcycle Handbook*, which you may obtain online at **www.dmv.ca.gov**, by mail, or at any DMV office. You may also make appointments at this website.

Please note that the motorcycle skills test may be waived if you complete the Basic Rider Course offered by the California Motorcyclist Safety Program (CMSP). To contact CMSP about this course, go online at **www.ca-msp.org** or call 1-877-RIDE411.

If you have questions or concerns about this letter, please contact DMV at 1-800-777-0133 (toll free) or 1-916-229-0370. The hearing impaired may call 1-800-368-4327.

Sincerely,

SHAMIM KHAN, Deputy Director
Licensing Operations Division

LOD 601 (REV. 1/2004) *A Public Service Agency*

«SEQUENCE»