Traffic Safety Facts
Traffic Tech – Technology Transfer Series

NHTSA
www.nhtsa.gov

Number 327 May 2007

Methodology for Determining Motorcycle Operator Crash Risk and Alcohol Impairment

Drinking and driving have been researched extensively, and the association between a driver's blood alcohol concentration (BAC) and crash risk is well understood. On the other hand, the effects of BAC on motorcycle operation are not well understood and the lack of data on the incidence of alcohol involvement in the on-road motorcycle-riding population doesn't permit adequate crash risk assessment.

To address this problem, the National Highway Traffic Safety Administration sponsored a research study to investigate alternative methodological approaches for determining: 1) the relative risk of alcohol-impaired motorcycle riders being involved in a crash, and 2) rider impairment at different BAC levels.

Methods

A literature review was performed that focused on: (a) past research on impaired motorcycle operation; (b) past research methodologies used to understand alcohol's effects on human performance, including laboratory simulation, closed-course operation, self-report surveys, crash investigation, and analysis of archival crash data; and (c) methodologies used to measure exposure in populations-at-risk, including roadside surveys. The literature review revealed a dearth of relevant research on impaired motorcycle operation. The most significant problem identified was the lack scientifically valid information on BAC levels among on-road non-crash involved motorcycle riders (e.g. the motorcycle population at risk). In addition to the literature review, an in-house analysis of fatal motorcycle crash data was conducted and discussed in this report.

Additional insights about alternative methodologies were obtained by conducting a workshop involving specialists in motorcycle safety, alcohol, and survey research, as well as law enforcement and other related fields. For each methodology under consideration, advantages, disadvantages, cost, and other issues were discussed. At the end of discussion, panelists provided their personal opinions as to which methodologies should be considered the highest priority for future research, based on feasibility and validity of the research methodologies.

Methodologies Assessed

Studies Providing Data on the Impairing Effects of Alcohol

Simulation Study—Using a laboratory-based motorcycle simulator with alcohol-dosed subjects, impairment can be determined by comparing performance of each rider at various BAC levels. Measures of performance on the same tasks involving activities such as balance, steering control, and braking would be compared when riders are sober (.00 g/dL BAC) and after drinking.

Closed-Course Study—This approach involves alcohol-dosed subjects riding motorcycles at low speeds on a closed (off-road) course outdoors. Performance of riders would be measured and compared to their performance at the .00 BAC level.

Field Studies Providing Both Crash and Comparison Data

Contemporary Case Control—Data associated with crashes (including BACs of riders) are recorded and compared to similar data from non-crash-involved riders at or near the same location as the crash. Factors such as time of day and day of week are matched carefully between crash and comparison cases.

Cohort Study—A sample of riders would be selected and alcohol use (e.g., BAC while riding) would be recorded over time, under naturalistic riding conditions along with data on any crashes that occur. Data could be collected using an instrumented motorcycle (to obtain BAC data, etc.) or by other methods, including surveys and diaries.

Emergency Department—Similar to a Contemporary Case Control study except that the interview with the crash-involved rider and BAC testing take place at a hospital.

Survey Study—Traditional survey techniques (e.g., phone, mail, or in-person surveys) are used to collect self-reported data from riders concerning their alcohol use and crash histories. Crash risk would be determined from these self-reports.

Studies Providing Crash Data

Fatal Crash Records—BAC data from motorcycle rider cases in the Fatality Analysis Reporting System (FARS) are obtained and compared to BAC data from motorcycle population-at-risk (exposure) data from a different source.

Injury Crash Records—BAC data on motorcycle riders from hospital records of motorcycle non-fatal injury crashes would be compared to population-at-risk data from a different source.

Studies Providing Comparison Data

Geo-General Comparison Data—Population-at-risk BAC data would come from general roadside surveys of motorcyclists, not from specific sites of previous crashes. Crash data would come from a different source (e.g., FARS).

Geo-Specific Comparison Data—Population-at-risk BAC data would be collected from visits to specific sites of previous motorcycle crashes found in archival data, such as FARS, which serves as the crash data source.

Gas Station Survey—This would be similar to the roadside collection of BAC and other data except that the survey takes place when riders stop to refuel. Survey data are then compared to crash data from another source (e.g., FARS).

Study Using Existing Data for Crash and Comparison Cases

Induced Exposure—Using archival data (e.g., FARS), the BACs of crash-involved riders deemed not to be at fault would be used for the population-at-risk and compared to BAC data for at-fault riders.

Findings

Each methodology was assigned to one of the three cost categories: Low = <$250K, Medium = $250K-$500K, and High = >$500K. Within each of these cost categories, methodologies were assigned to one of three levels of scientific validity (low, medium, and high). The assessment of scientific validity was determined by the contractor's project team, based on input from the expert panel, results of the literature review, and the past experience of the project team. With some exceptions, the methodologies rated highest for scientific validity were considered to be highest priority within their cost categories. For example, a methodology that would be highly valid scientifically (the Cohort study) was rated a low priority because it would be too costly and time consuming to conduct. The authors point out that the relative priorities could change as more exact information for each methodology becomes known.

Summary

Compared to impaired driving in cars and trucks, relatively little is known about the effects of alcohol on motorcycle operation. There are many methodologies which could be used to better understand these effects, each with its own set of advantages and disadvantages to be considered. Three methodologies–Simulation, Induced Exposure and Contemporary Case Control–were deemed the highest priorities for further research.

The results of this project are reported in two volumes:

Volume I: Synthesis Report on Alternative Approaches with Priorities for Research – This report summarizes the project findings, including a detailed discussion of the expert panel workshop. In addition, each methodology was prioritized as to its future research potential.

Volume II: Literature Review Report – This report discusses past research on impaired motorcycle operation, past research methodologies used to understand alcohol's effects on human performance, and methodologies used to measure exposure in populations-at-risk.

How to Order

For a copy of ***Methodology for Determining Motorcycle Operator Crash Risk and Alcohol Impairment, Volumes I and II*** (180 pages), prepared by the Pacific Institute for Research & Evaluation, write to the Office of Behavioral Safety Research, NHTSA, NTI-130, 1200 New Jersey Avenue SE., Washington, DC 20590, fax 202-366-7096, or download from www.nhtsa.dot.gov. Marvin Levy, Ph.D., was the Contracting Officer's Technical Representative for this project.

U.S. Department of Transportation
National Highway Traffic Safety Administration

1200 New Jersey Avenue SE.
NTI-130
Washington, DC 20590

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