

Appendix A – Supplement Report

This document is a collection of annotations (or summary of usefulness) for a series of international studies in relation to alcohol, impairment, and the effects that those things can have on rates of fatalities and traumatic injuries as it pertains to recreational boating. A total of 10 studies are included in this annotation document. The subsequent documents will include summaries of reports and studies involving alcohol and reports on what information is available. It will also highlight the fact that reporting of alcohol involvement in on-water incidents, especially non-fatal incidents is inadequate, leaving us with unanswered questions that still need to be addressed.

This document is a supplement to the original BUI Report published in 2019 and should be referenced together as one document.

A problem highlighted throughout these studies is that little information is available to the point of whether statutory limits on blood alcohol concentration (BAC) are an accurate determinate of impairment on the water. Alcohol use by passengers is equally dangerous to that of an operator, as not all injuries and fatalities are attributable to operator error, or even occur while the boat is in motion. Namely, the method of designating a sober operator alone is not effective.

Key points:

- The relative risk of death for intoxicated operators is more than 10 times that of sober operators.
- There is significant value in standardizing field sobriety tests for the marine environment.
- More research is needed on whether statutory blood alcohol concentration (BAC) limits are an accurate determinate of impairment on the water.
- Alcohol use by passengers presents a danger regardless of the activity of the operator.
- There is inadequate reporting of alcohol involvement in on-water incidents, especially non-fatal incidents.

Executive Summary of Alcohol and Drug Use in Recreational Boating

10 International Studies

Published range: 1990 - 2010

The relative risk of death for intoxicated operators is more than 10 times that of sober operators.

- Boat operators with a BAC level at or above 0.10 percent are estimated to be 10.65 times as likely to be killed in a boating incident than those with a 0.0 percent BAC.
- A disproportionately large number of intoxicated operators die in what should have been relatively safe conditions when compared to sober operators.
- The relative risk of death on the highway at BACs at or above 0.10 percent is 8.80, compared to 10.65 on the water. This could be because the boating environment is especially dangerous for persons at high levels of intoxication due to environmental stressors.
- Citation: *A Study of the Relationship Between the Risk of Fatality and Blood Alcohol Concentration of Recreational Boat Operators*
Peter Mengert, E. Donald Sussman and Robert DiSario - 1992

There is significant value in standardized field sobriety tests (SFST) for the marine environment.

- The accuracy of SFSTs is not degraded by translation to the marine environment.
- When tests were administered on land and on a vessel, BACs at or above 0.10 percent were correctly identified in 82 percent of cases.
- It was indicated that the use of SFST on the water will result in the arrest of a significantly higher number of intoxicated operators when compared to an officer's observation and interrogation alone.
- Citation: *An Experimental Evaluation of a Field Sobriety Test Battery in the Marine Environment*
E. Donald Sussman, Ann Needelman and Peter H. Mengert – 1990

More research is needed on whether statutory blood alcohol concentration (BAC) limits are an accurate determinate of impairment on the water

- While statutory BAC limits have been translated to the marine environment from the highway, these statutory limits are not based on the added risk of alcohol in the marine environment.
- Citation: *The Effects of Alcohol Upon Human Functioning in Recreational Boating*
Gordon S. Smith, A. James McKnight, Paul R. Marques and James E. Lange - 1994

Alcohol use by passengers presents a danger regardless of the activity of the operator.

- Boating fatalities reported to be alcohol-involved increased from seven percent in 1987 to 20 percent in 1991. Approximately one half of fatalities contained in this study occurred when the boat was drifting, at anchor or at the dock.
- Citation: *The Effects of Alcohol Upon Human Functioning in Recreational Boating*
Gordon S. Smith, A. James McKnight, Paul R. Marques and James E. Lange - 1994

There is inadequate reporting of alcohol involvement in on-water incidents, especially non-fatal incidents.

- When adjusting by one percent to account for under-reporting, BARD's fatality data is nearaccurate.
- Non-fatal incidents that require admission to the hospital are under-reported by approximately 19.7 percent. Non-fatal incidents that do not require admission to the hospital could be underreported by up to 93 percent.
- Citation: *Recent Research on Recreational Boating Accidents and the Contribution of Boating Under the Influence*
Bruce A. Lawrence, T.R. Miller and L.D. Maxim – 2006

Recreational Boating Accidents & Operators: The Efficacy of Anti-Alcohol Boating Legislation

Eric E. Anderson and W.K. Talley - 1990

In 1987, an anti-alcohol rider was added to the Coast Guard Appropriations Act that established a legal BAC limit of 0.10 on the water. This legal limit only applies to boat operators, not passengers.

An NTSB report (1983) on alcohol in recreational boating indicates that the full extent of alcohol involvement is probably not known. This directly correlates to the problem of under-reporting referenced in other literature. This study indicates that a significant number of non-fatal incidents are not reported, and the information that is reported from non-fatal incidents is inherently less reliable as much of it relies on self-reporting by participants in the incident.

Elevated BACs on the water are correlated with Friday and Saturday nights, male operators, two or more occupants on the boat and calm water. It is assumed that alcohol consumption (by an operator) is a determinate of the operator being at fault.

If policy action can reduce the operator's tendency to be at fault, it will reduce the propensity to cause incidents. Serious incidents are less likely to occur in larger, slower vessels, such as cabin motorboats, but when serious incidents do occur involving these vessels it is more likely to be the operator's fault rather than chance.

There is a positive relationship between speed and operator fault. As such, there is a negative relationship between boats at anchor or drifting and operator fault. There is an indeterminate relationship between the number of people on board and operator fault. Unless the passengers' interference with boat operation increases with their number: then the relationship would be positive. It's possible that having more people on the boat is a help to the operator as additional lookout, etc. In this case, there would be a negative relationship between number of people on the boat and operator fault. There is an indeterminate relationship between the adversity of the water conditions and operator fault.

The primary determinates of operator fault in fatal incidents are as follows: speed, operator inexperience, type of waterway and waterway conditions. The primary determinates of operator fault in non-fatal incidents comprise a more comprehensive list: speed, operator inexperience, type of waterway, visibility, alcohol use and the type of incident.

This study suggests that alcohol use is not an important/significant determinate of operator fault in fatal incidents. It is possible that this conclusion is because of insufficient variation in the observed values (only 20% of fatal incidents in their sample reported alcohol involvement).

On the contrary, alcohol involvement is seen as a highly significant determinate in non-fatal incidents. When alcohol is not involved, operators are less likely to be blamed for a non-fatal incident than fatal incidents.

Key finding: *Inconsistent with other studies contained in this report, this study indicates that alcohol use is not a significant determinate of operator fault in fatal incidents, however, the study cites that this finding could be biased due to insufficient variation in the observed values. The study found that alcohol use is a highly significant determinate of operator fault in non-fatal incidents. The primary policy implication reported by this study is that anti-alcohol legislation is more likely to reduce non-fatal boating incidents than fatal.*

An Experimental Evaluation of a Field Sobriety Test Battery in the Marine Environment

E. Donald Sussman, Ann Needelman and Peter H. Mengert– 1990

This study was an investigation into the accuracy of SFSTs on the water. It is important to note that the seated battery tests were not used here, but the traditional roadside tests (one-leg stand, walk and turn, horizontal gaze nystagmus) as well as finger to nose, finger count and tracing. Tracing was not tested as a part of this study because paper and pencil tasks are more difficult in the marine environment regardless of prior alcohol consumption. Two tests that were being used in the marine environment, alphabet recital and palm pat, were also administered. In a lab setting, 97 volunteers (similar in age to BUI arrests in Maryland, Ohio and two California counties over the previous two years) were dosed to reach BAC levels of 0.12 percent and 0.08 percent. Others were left at 0.0 percent. All participants spent approximately 1.5 hours on the water before being tested.

The tests were administered on land and on the vessel, and BACs at or above 0.10 percent were correctly identified in 82 percent of cases. It was indicated that FSTs on the water will result in the arrest of a significantly higher number of intoxicated operators when compared to an officer's observation and interrogation alone.

Up until this study, FSTs on the water had been used but not systematically tested for validity. This study found that the accuracy of FSTs is not degraded by translation to the marine environment. Important to note is that this study did not separate out their findings from the tests that require solid ground (one-leg stand and walk and turn) which may not be as reliable on the water, and those of horizontal gaze nystagmus, finger to nose, finger count and palm pat that are more recently used in the seated battery of field sobriety testing.

Key finding: *The findings of this study indicate that there is significant value in standardizing field sobriety tests for the marine environment. While this study was conducted nearly three decades ago, it serves to validate recent efforts to standardize a seated battery of field sobriety testing for use in the marine environment.*

A Study of the Relationship Between the Risk of Fatality and Blood Alcohol Concentration of Recreational Boat Operators

Peter Mengert, E. Donald Sussman and Robert DiSario – 1992

Note: A limitation of this study is that they were only allowed to interview and/or test on boating operators according to strict instruction and contingent grant funding.

This study was conducted in California and 357 boat operators were contacted to participate. Of these, 319 good tests were able to be used (one person refused the interview, 28 people refused the portable breath testing and nine resulted in bad or inconclusive tests). Of the operators contacted, 91 percent provided valid samples for testing.

The measure of relative risk resulting from this study is 10.65 per outing. Boat operators with a BAC level at or above 0.10 percent are estimated to be 10.65 times as likely to be killed in a boating incident than those with a 0.0 percent BAC. Relative risk measurements are important because only with objective estimates of relative risk can the problem of alcohol on the water be calculated accurately enough for resource allocation.

The equation to determine relative risk is fatal incidents with recorded BACs at or above 0.10 percent divided by exposure to operators with recorded BACs at or above 0.10 percent. This sum is divided by fatal incidents with recorded BACs at zero, divided by exposure to operators with recorded BACs at zero.

Possible sources of bias in this study is that those who refused the test might have had a different BAC distribution than those that were tested, the exposure data collected at night may have not been sufficient (28 tests were conducted at night, 291 during the day), and it is possible that the sites selected could be under representative.

If we assume that those who refused testing had higher BACs than those tested, the adjusted relative risk would be 8.38. If the night data that was collected is deemed insufficient, the adjusted relative risk would be 7.79. If sites selected had higher BACs than average sites, the relative risk would actually be significantly higher than what was calculated.

A recreational boat operator with a BAC at or above 0.10 percent has a fatality risk more than 10 times that of a sober operator. A disproportionately large number of intoxicated operators die in what should have been relatively safe conditions when compared to sober operators.

The relative risk of death on the highway at BACs at or above 0.10 percent is 8.80, compared to 10.65 on the water. This could be because the boating environment is especially dangerous for persons at high levels of intoxication due to environmental stressors.

Key finding: *The relative risk of death for intoxicated operators is more than 10 times that of sober operators. This study further highlights the dangers of alcohol consumption on the water, and indicates that when compared with the roadway, drinking on the water could be seen as more dangerous given the data. While this study was not given clearance to test passengers, previous studies have proven that a relative risk of death is the same for men and women, and for boat operators and passengers.*

The Effects of Alcohol Upon Human Functioning in Recreational Boating
Gordon S. Smith, A. James McKnight, Paul R. Marques and James E. Lange
– 1994

Alcohol is a part of the culture of recreational boating. A random survey of boaters returning from an outing indicated that 25 percent of boaters had alcohol in their system. At the time of this study's publication in 1994, it was reported that one half to two-thirds of the people killed in recreational boating incidents had been drinking.

This study is confined to recreational boaters (operators and passengers), and does not include those that are using the water for other purposes, swimming, bathing, etc. While statutory BAC limits have been translated to the marine environment from the highway, these statutory limits are not based on the added risk of alcohol in the marine environment.

The biggest differences in the alcohol use on the highway versus the waterway is who is drinking (operator/passenger), where the drinking occurs (often drivers are intoxicated when they get behind the wheel, it is more common for boaters to continue to drink while underway), how much they drink and what the alcohol does (not only its effect on the performance of the activity/operation of the vessel, but also the increased vulnerability to the environment on the water). For these reasons, it is potentially dangerous to think these strategies are transferrable. The strongest example of this is the mitigation strategy of designating a sober driver. While impaired passengers may not pose much of a risk to others, they pose a great risk to themselves.

Instances of driving under the influence decreased by 20 percent in the decade prior to 1992, instances of boating under the influence increased in the same time period.

This study references several others with related testing and results. In a 1990 random digit dialing survey, conducted by Howland, Mangione and Hingson, Massachusetts residents over the age of 19 were surveyed. Of these surveyed, 75 percent reported participating in an aquatic activity in the previous month. During their last aquatic activity, 36 percent of men and 11 percent of women reporting drinking.

The American Red Cross conducted a study in 1991 on the specific activity of boating. The survey included 3,700 boaters as participants and 29 percent claimed to have consumed alcohol on a typical boating outing. The highest rate of drinking was among cabin cruiser vessels (45 percent) and cabin sailboats (42 percent). The highest rate of self-reported drinking was among 20 – 40-year-olds, and it was higher among males (33 percent) than females (24 percent). Across drinkers in all categories, one out of 15 participants reported consuming five or more drinks during a typical outing.

The National Traffic Safety Board (NTSB) conducted a study in 1993 and found that 40 percent of recreational boaters carry alcohol in route to boating outings. Burwell-Hay and Martin Research (1988) conducted a survey of small craft usage in Canada. Of those surveyed, 37 percent of boaters claimed to have consumed alcohol on their most recent outing.

A limitation common to all of these studies cited is that they rely on accurate self-reporting. Given that there is a benefit to boaters to underestimate their alcohol use, rather because of the stigma or fear of getting in trouble, there is reason to believe that the numbers reported by these studies are an underestimation.

Hoxie et al. found in that in relation to other fatal accident victims, the following groups were overrepresented in the data on alcohol-related boating fatalities: males ages 20 – 49, Friday and Saturday nights, calm water, two or more occupants, falls overboard and operator error.

Drinking to some extent is more closely associated with boating than driving, but heavy drinking is more characteristic of driving. The most data is available on boating fatalities, and the least amount of data is available on alcohol involvement in non-fatal incidents.

The NTSB further examined USCG reports and found that boating fatalities reported to be alcohol-involved increased from seven percent in 1987 to 20 percent in 1991. Approximately one half of fatalities contained in this study occurred when the boat was drifting, at anchor or at the dock. More research is needed on the risks that drinking passengers pose to themselves regardless of the activity of the operator.

This study further addresses the effects of alcohol consumption on a person's body and their ability to survive, including findings regarding the following: temperature regulation, body water changes, cardiovascular regulation and environmental stressors.

Key finding: *More research is needed on whether statutory BAC limits are an accurate determinate of impairment on the water or if they should be adjusted from highway limits to account for environmental factors.*

Attitudes Concerning Boating Under the Influence **Phil Balducci & Associates, Inc. – 1995**

This study was conducted by Phil Balducci & Associates, Inc. through the utilization of five focus groups. These focus groups which included a wide spectrum of boat owners were conducted in Ft. Lauderdale, Florida; Springfield, Missouri; Minneapolis, Minnesota; and Sacramento, California. A group consisting of marine education, public service officials and alcohol addiction professionals was also conducted in Florida.

There were three categories of feedback received from the focus groups. The first category of feedback is used to determine what boaters find to be reasonable and acceptable on-water behavior. Boaters believe that it is legal and acceptable for boat passengers to be intoxicated, and as long as there is a designated driver, it is acceptable for others on the boat to be over the legal BAC limit. Boaters believe that it is not reasonable to expect that people would completely stop drinking while boating.

The focus groups said that what will motivate a reduction in drinking while boating, the second category of feedback, is only the fear of getting caught. Most say that even when they are

drinking, they still believe that they are in control and if something happens, it will be someone else's fault.

The third category of feedback is the focus groups' reaction to government regulations regarding boating under the influence. People are generally fine with the idea of designating a sober operator. Most agree, when pushed on the subject, that passenger consumption is a dangerous issue, but all think that it'll be much harder to change this culture than it is to just push designated driver.

The focus groups' suggestion was to get people's attention about alcohol when they are actively thinking about going boating. For example, target alcohol-related messaging at marinas, boat ramps, fishing stores, etc. The focus groups suggest that the USCG take the lead on this messaging assuming the approach does not come across as boring, outdated, unrealistic or preaching and that these messages should be coordinated with a single message and theme. The groups cautioned against groups using conflicting messages or slogans to combat the same problem.

The most positively received recommended messaging material presented to the focus groups was a laminated safety/emergency information card.

Key finding: *Focus groups are open to the idea that designating a sober operator would prevent injuries and fatalities based on a similar experience on the highway. They are resistant, however, to a dry water approach given the culture of alcohol on the water and caution against any approach to messaging that could be taken as preachy. Additional research should be done on the dangers of passenger consumption, and once that research is made available it is possible that perceptions of this issue could change.*

Field Sobriety Testing in the Marine Environment

A.J. McKnight, J.E. Lange and A.S. McKnight – 1997

Note: While the results of this study are important for inclusion for the purpose of historical reference, it is important to note that the testing procedures used are not all contained in the current practice of marine field sobriety tests.

In controlled lab testing, participants were systematically dosed until they reached a certain blood alcohol concentration (BAC). The purpose of this study was to determine the accuracy of field sobriety testing in distinguishing boat operators with BACs above or below 0.10 percent. The tests administered were horizontal gaze nystagmus (HGN), alphabet recital, hand-pat, finger to nose and countdown with snaps. A field study was also conducted.

As anticipated, HGN had the strongest relationship with BAC. The HGN test alone correctly identified 87.5 percent of BACs over 0.10 percent and 81.81 percent of BACs below 0.10 percent. With only the HGN test, officers would have been accurate in their decision on impairment 55 out of 60 times in the field study. The reason that HGN is not used exclusively is that the other tests better identify impairment at higher BAC levels, and that the objective performance on other tests is more readily accepted by judges and juries.

A limitation of field tests is they don't generally capture BAC levels on participants that pass to validate their findings. Additionally, correlations between BAC levels and the type of tests are usually higher in a lab setting, most likely because there is a greater range of BACs found in the field than those that are demonstrated in the lab.

None of the tests used showed any gender bias. A significant relationship was determined between the count down with snaps test and the number of hours a participant spent on the water. This could be an indication that this test may be more of a measurement of fatigue rather than impairment.

Key finding: *A key finding of this study is the validity of HGN testing. While it is more difficult to demonstrate to a jury because of the subjective nature of an officer's observation, this test alone serves as an excellent baseline indicator and in the field study this test correctly identified impairment with more than 90 percent accuracy.*

Recent Research on Recreational Boating Accidents and the Contribution of Boating Under the Influence

Bruce A. Lawrence, T.R. Miller and L.D. Maxim – 2006

Boating accident statistics are widely used in the recreational boating safety community for identifying trends, characterizing accident causes, assessing the contributions of operator error, mechanical malfunctions and environmental factors, and evaluating the benefits of government initiatives.

Non-fatal boating incidents are strikingly under-reported, specifically incidents that result in less serious injury or property damage alone. The problem of under-reporting also means that the risks of non-fatal boating incidents are so underestimated that boaters may not take necessary precautions to control or reduce their level of risk. Alcohol consumption increases the likelihood and severity of boating incidents.

The Pacific Institute for Research and Evaluation (PIRE) conducted a study in 2002 based upon the comparison of BARD and other government sources that have data on injuries to get a more accurate look at the under-reporting problem. In terms of fatal injuries, BARD is generally correct or only off by a little. The PIRE study indicates that the U.S. Coast Guard adjusts the fatality count up by one percent to account for any under-reporting, and this method proved valid.

In terms of non-fatal incidents that required admittance to a hospital, BARD captures most of these, but consistently misses about 20 percent. In terms of non-fatal incidents that do not require admittance to a hospital and are treated in an emergency room, urgent treatment center or by other means, the study captured more than 30,000 of this category of incident in 2002, while BARD only reported 2,309. The PIRE research suggests that the U.S. Coast Guard consider using statistical adjustments (similar to what is done for the fatality data) to account for under-reporting. Since fatal injuries are the most consistently reported, and the costliest, the extent of under-reporting in terms of pure economic impact is no more than 25 percent.

Between 2002-2003, BARD reported at least 23 percent of fatalities and nine percent of non-fatal injuries resulted from incidents with drugs or alcohol involved. These numbers underestimate the involvement of alcohol and drugs, possibly because some of the BARD data (especially in non-fatal incidents) rely on self-reporting, in which participants have an incentive to downplay their drug or alcohol use. In 2002, the USCG estimated that 70 percent of fatalities were drownings and nearly 85 percent of these victims were not wearing a personal floatation device (PFD).

An incident constitutes required reporting if it meets the following criteria: a person dies, a person is injured and required medical attention beyond first aid, damage to a vessel exceeds \$2,000.00 or it is a complete loss, or a person disappears, and circumstances indicate possible injury or death.

PIRE identified several opportunities for improvement to the BARD reporting system. At the time of the study, certain incidents were not required to be reported, when doing so may provide a more accurate depiction of the problem. More concerning is that some incidents are not reported because boaters are not aware that they are required to report them. It is believed that nearly all fatal incidents are captured by BARD, but reporting is far from complete for other types of incidents. The numerator problem, identified by PIRE is that we do not know the true economic and social costs of these incidents, fatal or otherwise. The denominator problem is that the fatality and injury rates are calculated based off of numbered vessels. The problem with this is that not all vessels are required to be registered, and not all types of vessels have the same frequency and duration of use.

Incidents involving death or serious injury are the best for study due to these incidents having the greatest social and economic impacts. Incidence estimates are computed at the state level and then aggregated to establish a national total. Interstate comparisons should only be made with data spanning several years. Between 2002 BARD and multiple cause of death data (MCOB), which is compiled by the National Center for Health Statistics and records every death in the United States as well as causes of injury, the fatality data is consistent with the USCG practice of adjusting up by one percent.

Non-fatal incidents that require admission to the hospital are under-reported by approximately 19.7 percent. If errors of omission are predominating in this category, states should choose the larger number reported by BARD or other government datasets. Non-fatal incidents that do not require admission to the hospital could be under-reported by up to 93 percent.

Key finding: *As referenced by other studies, under-reporting is a significant problem in recreational boating safety surveillance. This study quantified the problem of under-reporting to show the striking volume of incidents, alcohol related or otherwise, that is not being captured in BARD data. Actions must be taken to combat the under-reporting problem in an effort to capture a real picture of the number of alcohol-involved incidents.*

Alcohol Consumption Among Recreational Boaters: Factors for Intervention
J.R. Miller and T.J. Pikora – 2008 (Australia)

In Australia in 2002, boating incidents caused more harm than rail or air crashes combined. In terms of transportation alone, boating incidents were second only to motor vehicle crashes in terms of total injuries caused.

Very few non-fatal boating incidents are investigated for alcohol involvement, even though it is a required part of the investigation of motor vehicle crashes. Time delays for the arrest of boating suspects may restrict the use of alcohol testing, even in cases where that information is gathered.

In a 1999 U.S. study, 30 – 40% of recreational boaters admitted to consuming alcohol while out on the water.

Methodology

- In a survey of 500 boat owners, a total of 35 questions were asked and four of those questions were about alcohol.
- When questioned whether or not the participant believed it was safe for passengers to drink (with a designated sober operator), 43.8% agreed that it would be safe for passengers to drink, and 40.4% disagreed.
- Of the participants, 6.2% thought that alcohol would have less of an effect on people (who were boating) because they were outside.
- The odds of consuming alcohol were significantly associated with having completed a boater education course and having children under the age of 12 on board the vessel.
- When asked if they agreed that boating under the influence (BUI) is a safety concern, 31.6% of participants said yes.
- Of the participants, 18.6% reported having a drink on their most recent boating trip.

No information was requested of boat passengers in this study, only of registered boat owners. For several reasons, the administrators of this survey indicated that the reported percentages may be an underestimation.

- Participants in a study may be uncomfortable self-reporting their alcohol use.
- Males tend to under-report drinking and alcohol consumption levels.
- The sample of participants surveyed was an older age group and only included registered boat owners, who may be more safety conscious than the average boater.

Self-reported data is a serious limitation of this study. A study out of New Zealand, conducted around the same time, was referenced as having used self-reported data along with a breath test and found those results to be more reliable.

Key finding: As with other studies, this study indicated that boat operators and passengers have the same relative risk of dying on a boat when the subject consumes alcohol. Future studies should include more questions about alcohol and should be administered to boat operators and passengers alike.

Validation of Field Sobriety Tests for the Marine Environment

Dary D. Fiorentino - 2010

****NOTE:** This article describes the field study referenced at the end of *Development of Sobriety Tests for the Marine Environment*.

Alcohol consumption increases the risk of dying while boating (for operators and passengers). Between 2003-2004, up to 70% of drowning victims testing positive for alcohol.

Officers on the water face difficulty in identifying possible impairment for several reasons, including: the lack of an established speed limit on some waterways means that excessive speed may not be a clue of an impaired operators, and environmental stressors/conditions may make it hard to determine an accurate degree of impairment.

In 2010, 1,146 boating under the influence (BUI) reports from 14 states indicated that other than the three regularly administered SFST tests, no test was uniformly administered on the water from state to state or even between agencies. A lack of standardization of testing could result in the uneven application of sanctions and penalties for BUI across and between states.

The objective of this project was to develop and validate seated sobriety tests to assist water patrol in detecting BACs at or above 0.08%. The study was conducted on the Lake of the Ozarks and involved the four established seated sobriety tests and a breath test to verify the results. This location was chosen for two reasons: Missouri State Water Patrol cooperated with the study, and this lake is popular with enough BUI cases yearly to support adequate data collection.

Methodology

- Officers were trained in administering the four tests until they were proficient and comfortable administering and scoring the tests.
- The tests were administered at all hours of the day, either with probable cause or at sobriety checkpoints, and in varying weather conditions.
- Officers were to administer the four tests in order (HGN, FTN, PP and HC) to each BUI suspect, and then use the pattern of results for each test to estimate the probability that the suspect has a BAC at or above 0.08%.
- When possible, if an observer was present, the observer would score the FTN, PP and HC tests while the officer administered them. The observer could not assist in scoring the HGN test (as they were not able to see the suspect's eyes from their position on the vessel).

Results

The testing procedure with the highest correlation to BAC is a combination of the four tests: horizontal gaze nystagmus (HGN), palm pat (PP), finger to nose (FTN) and hand coordination (HC). There is no statistically significant difference in the data collected with or without observers.

The best combination of two tests is HGN and FTN, yielding a correct prediction of BAC level in 75% of cases. The best combination of three tests is HGN, FTN and PP, yielding a correct prediction of BAC level in 72% of cases. All four tests combined yields a correct prediction of

BAC level in 68% of cases. HGN, when combined with any one of the other tests, yields a correct prediction of BAC level in 85% of cases. Without HGN, the best predictor of BAC status was a combination of the other three tests (FTN, PP and HC). This combination yields a correct prediction of BAC status in 66% of cases.

This was the first field test to systematically determine the usefulness of four on-water tests. The sample size consisted of participants 18 – 80 years old, primarily Caucasian males. BACs were recorded ranging from 0.00% - 0.32%. With a positive HGN test, there is a higher than 80% probability that the person will have a BAC at or above 0.08%. It is worth noting that BACs at or above 0.08% were less prevalent in this study than in other field studies of traditional SFSTs.

Key finding: *This field test further validated the usefulness and accuracy of the seated battery of field sobriety testing. While the field test verified the ability of an officer to make accurate predictions of BAC status using the HGN test alone, it expounded upon the testing to provide an explanation of which tests work the best in combination (HGN, FTN and PP).*

Development of Sobriety Tests for the Marine Environment

Dary D. Fiorentino; B. Dietel; and D. Jimenez - 2011

Evaluating Seated Battery Tests

Using a series of four of the established seated battery tests, including the horizontal gaze nystagmus (HGN), finger-to-nose (FTN), palm pat (PP), and hand coordination (HC) tests, the testing of 157 randomly assigned subjects yielded an overall correct percentage of 72.3% (correctly classified 82% of the BACs at or above 0.08%, and accurately classified 67% of the BACs at or below 0.08%).

Methodology

- 157 subjects participated in the study. Of the 195 initially called, 17 did not appear, eight were dismissed for illegal drug use and 13 were dismissed because of evidence of health problems.
- The subjects ranged in age from 21 – 62 years old.
- The subjects' gender makeup was 50.3% male and 49.7% female.
- The subjects were randomly assigned to blood alcohol concentration groups (0.00%, 0.04%, 0.08% and 0.12%).

Six tests were evaluated: Finger to nose (FTN), time estimation (TE), finger count (FC), hand coordination (HC), palm pat (PP) and horizontal gaze nystagmus (HGN). Only four of the tests were found to have statistical significance in predicting BAC status.

Of the individual tests, only HGN positive or negative reliably predicted BAC status (67.4%), indicating the FTN, PP and HC did not improve the prediction beyond that of HGN.

Evaluation of SFSTs (to compare)

The second of two studies conducted by the Southern California Research Institute in the late 1970s/early 1980s to develop what we now consider SFSTs used a series of three established

tests, horizontal gaze nystagmus (HGN), walk and turn (WAT), and one leg stand (OLS), to measure the effectiveness of the tests. The testing of 297 randomly assigned subjects yielded an overall correct percentage 81.2%.

Reason for Establishing Seated Battery

The OLS and WAT tests have to be administered on solid ground. In an on-water situation, this requires the officer to take a subject to land and wait a prescribed amount of time (generally 15 minutes) for the person to acclimate. More than just taking up valuable time, this could give a subject time to potentially “sober up.”

What Rules Still Apply

As with the SFSTs, the Seated Battery of Field Sobriety Testing must be easy to administer as to not overburden law enforcement officers who still have to monitor the situation for their own safety, as well as the safety of the subject(s) and witnesses.

This study focused on lower BACs levels than previous studies conducted, and the wider distribution of BACs in those previous studies may have made it less difficult to determine impairment. The tests included in this study has a lower correct percentage and sensitivity than traditional SFSTs, but the field study (reported elsewhere) indicated results consistent with SFSTs.

Key finding: *The seated battery of field sobriety testing is validated to the level of the roadside tests and is an important key in establishing impairment of a boat operator beyond that of officer’s observation and interrogation. The seated battery of field sobriety testing is a crucial key of establishing impairment on the water in a manner that preserves the integrity of the investigation as well as the officer’s time and safety.*

APPENDIX B – Dashboard Updates

BUI Report and Dashboard: 3319FAN119214

Submitted for USCG approval

Dashboard – Vehicle Operating Privileges

Link:

<https://idash.nasbla.net/idashboards/viewer/?guestuser=guest&dashID=97&c=0&NRD=True>

Description: This dashboard is color-coded to indicate how a BUI conviction effects a person’s motor vehicle or vessel operation privileges (motor vehicle, boating, both or neither). Two territories are grey to indicate no data was gathered. Most states and territories are coded red to indicate that neither privilege is affected by such a conviction.

The following states are coded purple to indicate that an individual’s motor vehicle privileges are affected by a BUI conviction: Alaska, Hawaii, Texas, Kansas, Arkansas, Illinois, Indiana, Maryland, New Jersey and Massachusetts. The following states are coded green to indicate that both a person’s motor vehicle and vessel operating privileges are affected by a BUI conviction: Washington, Utah, Minnesota, Louisiana and New Hampshire.

On the right-hand side, there is a panel that describes how the vehicle operating privileges (for motor vehicle or boating) are affected for each state. An end-user can click a state from the map on the right-hand side, and the description of how a person’s operating privileges are affected by a BUI conviction in the state will appear in the side panel.

In the 2019 grant cycle, it was noted that no states or territories are coded yellow, which indicates that there is not a state or territory in which only a person’s boating privilege would be affected by a BUI conviction. Upon further research and data collection, it was determined that 18 states and Puerto Rico should be coded yellow to indicate that a person’s vessel operating privileges can be affected by a BUI conviction: Florida, South Carolina, Georgia, Alabama, Mississippi, Tennessee, Virginia, Ohio, Michigan, New York, Vermont, Rhode Island, Iowa, North Dakota, Nebraska, Colorado, Wyoming and Idaho.

Source: State BUI Laws Survey – BLA Survey, Fall 2019

Dashboard – BUI Citations

Link:

<https://idash.nasbla.net/idashboards/viewer/?guestuser=guest&dashID=98&c=0&NRD=True>

Description: This interactive dashboard includes a heat map of the United States on the left-hand side that indicates the number of BUI Citations per state in 2019. The legend provides a corresponding color for no data (grey), and from 0 to four hundred citations (green to red) by intervals of 50 citations.

On the upper right-hand side, the graph shows a line graph of BUI citations for all states by year. This map does not change regardless of your state selection. The graph on the lower

right-hand side shows BUI citations by year for any state selected on the map. The map will not allow you to select a state with no data.

Source: State RBS Performance Report Part II.

Dashboard – Operation Dry Water Agency Results

Link:

<https://idash.nasbla.net/idashboards/viewer/?guestuser=guest&dashID=99&c=0&NRD=True>

Description: This interactive dashboard features a dot map that pinpoints each of the agencies that participated in the 2020 Operation Dry Water (ODW) campaign. Each dot on the map recognizes a participating agency, and when selected, that agency’s report will appear in the right-hand side panel.

Each agency reported on the number of officers they had working on the campaign, the number of vessels contacted, the number of boaters contacted, the number of citations issued, the number of BUI-Alcohol violations, the number of BUI-Drug violations, the highest recorded BAC level (if known) and the number of boating safety warnings issued. The report also includes a record of any specific locations that the agency covered and any other agencies/stations that participated. This dashboard was updated to reflect the 2020 campaign year.

Source: Operation Dry Water 2020 – Agency Report Form

Operation Dry Water – Results by Campaign Year

Link:

<https://idash.nasbla.net/idashboards/viewer/?guestuser=guest&dashID=81&c=0&NRD=True>

Description: This interactive dashboard features four bar and line graphs that include data from 2010 – 2020 for the purpose of comparison, as well as a “speedometer” measuring the highest blood alcohol arrest for a given year. The four dashboards include data for the following topics: the number of participating agencies and officers, the number of vessel contacts and boater contacts, the number of non-BUI citations and warnings issued, and the number of BUI citations issued. All of these graphs indicate an increase in contacts made and citations issued, demonstrating an increased focus on BUI enforcement.

Agencies & Officers –

This dashboard shows a bar and line graph with data for each year 2010 – 2020. The bar, measuring at 620 for 2020, represents the number of agencies that participated in the Operation Dry Water campaign. The line, measuring at 7,612 for 2020, represents the number of officers that conducted patrols as a part of the Operation Dry Water campaign.

Vessel & Boater Contacts –

This dashboard shows a bar graph with data for each year 2010 – 2020. The navy bar (on the left of each set) represents the number of vessel contacts recorded as a part of the Operation Dry Water campaign. For 2020, the navy bar indicates 105,517 vessel contacts. The teal bar (on the right of each set) represents the number of boater contacts recorded as a part of the Operation Dry Water campaign. This number is expectedly higher than that of vessel contacts, as many vessels have more than one person aboard. For 2020, the teal bar indicates 305,466 boater contacts.

Non-BUI Citations & Warnings –

This line graph illustrates the number of non-BUI citations and warnings issued each year throughout the Operation Dry Water heightened awareness and enforcement weekend. The yellow region of the line graph indicates the number of warnings issued in a given year. In 2020, there were 28,659 non-BUI warnings issued during the Operation Dry Water campaign. The red region of the line graph indicates the number of citations issued in a given year. In 2020, there were 8,666 non-BUI citations issued during the Operation Dry Water campaign.

Boating Under the Influence (BUI) Citations –

This line graph illustrates the number of boating under the influence (BUI) citations issued during the Operation Dry Water heightened enforcement weekend for each year 2010-2020. In 2020, there were 625 BUI citations issued.

Highest Blood Alcohol Arrest by Year –

This interactive dashboard is set up to model a speedometer and contains data for the highest blood alcohol arrest during the Operation Dry Water campaign for a given year. When a year is selected on any of the other graphs, this graph will adjust to show the highest blood alcohol arrest for that year. In 2020, the highest blood alcohol arrest was a BAC of 0.368 percent.

Source: Operation Dry Water 2020 – Agency Report Form

APPENDIX C - Trends

BUI Report and Dashboard: 3319FAN119214

Submitted for USCG approval

Please note that these are general trends observed from the BUI Dashboard data and not an explanation of current law or legislation in any regional area or state.

Dashboard – BUI Citations

Link:

<https://idash.nasbla.net/idashboards/viewer/?guestuser=guest&dashID=98&c=0&NRD=True>

Source: State RBS Performance Report Part II.

Trend: This dashboard shows the number of boating/operating under the influence citations for 2019 and the previous 10 years by state. In some states, listed below, BUI citations have trended downward over the last three to five years, others have trended upward, and others still have remained fairly consistent.

The following states have trended downward in BUI/OUI citations over the three-to-five-year period prior to 2019: Delaware, Illinois, Indiana, Michigan, Missouri (while showing promise of a downward trend in 2019, the three previous years indicated consistency), New Hampshire, North Dakota (the last three years have shown consistency in North Dakota's OUI/BUI citations, but a striking increase between 2015-2016 indicates a downward trend), Oklahoma, Pennsylvania, Tennessee and Washington.

Alabama noted a significant decrease in OUI/BUI citations in 2018 and 2019 in comparison to years prior, but the indication of zero citations issues compared to 72 and 43 in 2016 and 2017, respectively, calls into question possible errors in the data.

The following states have trended upward in BUI/OUI citations over the three-to-five-year period prior to 2019: Connecticut, Florida, Idaho (while Idaho reported lower numbers of BUI/OUI citations issued in 2019, their trend remains as a significant increase was measured from 2016-2018), Iowa, Kentucky, Nevada and U.S. Virgin Islands.

North Carolina noted a significant decrease in OUI/BUI citations in 2019 in comparison to years prior, but the indication of zero citations issues compared to 127 and 193 in 2017 and 2018, respectively, calls into question possible errors in the data.

Alaska noted a significant increase in 2019 to 13 OUI/BUI citations, but with zero citations issued in both 2017 and 2018, it is too early to consider the increase a trend and future data is needed.

The following states have remained generally consistent in the number of BUI/OUI citations over the three-to-five-year period prior to 2019: American Samoa, Arizona, Arkansas, Colorado, District of Columbia, Guam, Hawaii, Kansas, Louisiana, Maine, Maryland, Massachusetts, Minnesota, Mississippi (after a striking increase in OUI/BUI

Dashboard – Boating Under the Influence (BUI)

Link:

<https://idash.nasbla.net/idashboards/viewer/?guestuser=guest&dashID=96&c=0&NRD=True>

Trend(s):

Blood Alcohol Content Level –

There are no trends to be demonstrated by this dashboard other than that the vast majority of the country adheres to the per se blood alcohol concentration (BAC) limit of 0.08 percent.

Legalized Cannabis –

The southeastern and midwestern regions of the country have maintained the illegality of marijuana use in any form. The western/pacific region of the country has predominately legalized both medical and recreational uses of marijuana.

Vehicle Operating Privileges –

In the southeastern region of the country, a boating under the influence conviction will affect only a person's vessel operating privileges. In the southwestern region of the country, a boating under the influence conviction is not likely to affect either a person's motor vehicle or vessel operating privileges. Reminder that these are general trends and not an explanation of current law or legislation in any regional area or state.

Implied Consent –

There are no trends to be demonstrated by this dashboard other than that the vast majority of the country has some form of implied consent.

Preliminary Breath Test Instrument Use –

The majority of the country allows preliminary breath test instruments to be used to establish probable cause.

Safety Inspection as Primary Reason for Stop –

The majority of the country allows a safety inspection to be used as the primary articulable reason for stopping a vessel.

Source: State BUI Laws Survey – BLA Survey, Fall 2019

Dashboard – Vehicle Operating Privileges

Link:

<https://idash.nasbla.net/idashboards/viewer/?guestuser=guest&dashID=97&c=0&NRD=True>

Trend: The trends identified using this dashboard are listed above as a part of the larger dashboard description.

Source: State BUI Laws Survey – BLA Survey, Fall 2019