

# **Fatal Motorcyclist Crashes: Ride-along Factors: Correlation, Causation and Countermeasures**

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## **Introduction**

This paper will (1) describe five factors (or variables) data analysis and research has identified as regularly associated with or that ride-along with fatal motorcyclist crashes (2) define the meaning of correlation and cause and discuss each of the 5 factors in that context (3) share the authors recommendations based on our understanding of the research.

The authors credit the phrase “ride-along factors” to Dr. Carol Flannagan, a researcher with the University of MI Traffic Research Institute. It is a descriptive term for factors or variables that are associated with fatal motorcyclist crashes.

## **Correlation and Causation – introduction**

We want to start with briefly identifying our thinking regarding correlation and cause. Then we will introduce the ride-along factors and come back to correlation and cause in a bit more detail.

First off, most readers will have heard the phrase, “correlation is not causation?” We hear that so often you’d think it would be easy to tell the difference between factors that merely correlated and those where change in one factor influences a change in the other. But in practice it’s not always easy. A correlation between variables does not automatically mean that the change in one variable is the cause of the change in the value of the other variable. If we don’t get this relationship correct, we might direct our efforts in the wrong place - we might do the same things over and over and wonder why nothing improves.

We will come back to correlation and cause in more detail but for right now, let’s get started by introducing the most common ride-along factors.

## **Common Ride-along Factors**

The idea of ride-along factors is not new. Experienced motorcyclist safety professionals have an understanding of the concept of ride-along factors (although the descriptive term we are using may be new). Some of these factors are confirmed by data analysis and research. Other factors we identify as ride-alongs have either not been researched or not confirmed by the research conducted.

The five most commonly identified ride-along factors that have been confirmed by data analysis or research are listed below. We call them the “big four plus one” because the first four are common sense regularly identified factors while the fifth is often overlooked.

1. Alcohol (or other drug) impairment or had been drinking
2. Speeding
3. Not wearing a helmet

4. Operating without a valid motorcycle operator license (often associated with lack of formal training)
5. Previous driving violations

Motorcyclist safety programs commonly address these first four in attempts to reduce crashes and fatalities.

Rider training and licensing are often connected so many safety programs focus major efforts on getting riders into basic training which in most cases allows them to be licensed. We will address the research regarding these connected countermeasures later. The fifth ride-along (previous driving violations) is not often identified and almost never used to design and implement possible countermeasures.

### **More on Correlation and Cause**

Correlation describes an association between types of variables: when one variable changes, so does the other. A correlation is a statistical indicator of the relationship between variables. You can have a strong correlation or a weaker one but these variables change together. They covary. But this covariation isn't necessarily due to a direct or indirect causal link. To find the cause of covariation, we need more information than mere correlation. If one variable causes the other, how do you know which one?

There could be a third variable problem which means that a confounding variable independently affects both variables to make them seem causally related when they are not.

For example, ice cream sales and violent crime rates are closely correlated, but they are not causally linked with each other. Instead, hot temperatures, a third variable, affects both variables separately. Failing to account for third variables can lead to biases creeping in and effect our work.

Here is another ice cream example There's a correlation between eating ice cream and getting sunburned. The two events are related. But neither event actually causes the other. Instead, both events are caused by something else—sunny weather.

Causation means that changes in one variable bring about changes in the other; there is a cause-and-effect relationship between variables. The two variables are correlated with each other and there is also a causal link between them. A correlation doesn't imply causation, but causation always implies correlation.

As an example, smoking causes cancer. Scientists have known that smoking causes cancer since at least the 1940s, when studies showed a clear link between smoking and lung cancer. Smoking happens first, and lung cancer develops later. So, it's clear that smoking would cause lung cancer instead of *vice versa*. And we have more evidence for this causal relationship. Experiments conducted in the 1950s confirmed that the chemicals in cigarette smoke could cause cancer in mice. By the time the US Surgeon General issued his warning against smoking in 1964, there was overwhelming evidence that cigarettes were deadly.

## **Back to the Five Ride-Along Factors – two questions**

Next we will address two questions with each identified ride-along.

1. Does the identified ride-along factor contribute to causing the crash, contribute to the fatality, both or neither?
2. Is the ride-along factor related to the fatal crash as a cause or is the relationship correlational in nature? In addition to addressing these two questions we will share a bit of the research & reasoning behind the answers.

### **Alcohol**

First up, alcohol impairment. Does it contribute to causing the crash? Certainly, A big YES and no big surprise here. What is it about alcohol impairment that contributes to the likelihood of crashing? Alcohol is a drug that affects perception, judgment, coordination and reaction time. Impaired riders have a reduced ability to search for hazards, evaluate risk factors and execute physical actions. Judgment and vision are usually the first abilities to suffer. Alcohol slows a rider's ability to process information and respond to critical driving tasks.

Second question. Does alcohol impairment contribute to causing an injury leading to death? Yes? No? Maybe? We find no research indicating that alcohol impairment contributes to an injury causing death. There is some talk in the motorcyclist community that being impaired might actually help avoid injury based on the idea that your limp, loose impaired body is better able to tumble and roll without getting injured. We find no research to support that idea.

We do however find research that MAYBE alcohol impairment actually helps prevent death resulting from a severe injury from occurring. That is a big maybe because the experimental and clinical reports contain some conflicting results.

However, the body of evidence indicates that alcohol impaired crash victims are less likely to die from their severe injuries.

The reason for this revolves around the idea that it is the body's response to the injury rather than the severity of the injury that determines whether an injury ends up being fatal, and that alcohol helps numb the body's reaction to trauma. The research indicates that alcohol acts as a buffer and prevents these physiological reactions, thereby preventing fatal complications.

We know alcohol impairment contributes to the risk of crashing. We find no research to indicate alcohol impairment lessens the risk of injury and a big maybe that being impaired might help keep you from dying from a severe injury. So, what is the bottom-line message on alcohol and motorcyclist safety? Our answer – alcohol & riding certainly should never mix.

### **Speeding**

The research confirms, as readers will surmise, that speeding contributes to both the cause of the crash and the injury leading to death. Speed influences the risk of crashes in three basic ways:

1. It increases the distance a vehicle travels from the time a driver detects an emergency

to the time the driver reacts. At the same reaction time, more distance is covered at higher speed.

2. It increases the distance needed to stop a vehicle once the driver starts to brake. Between reasons 1 & 2, speeding increases the total stopping distance and limits margin available to stop before an obstacle.
3. Even if the motorcyclist chooses a non-stopping response, speeding increases the risk that an evasive steering maneuver will result in loss of control.

Speeding also increases the risk of injuries because:

1. It increases the crash energy exponentially. For example, when impact speed doubles the energy that needs to be managed quadruples. This affects how well personal protective gear can do its job. The laws of physics determine that the force of impact increases with the square of the increase in speed. So, if you double the speed of a car, you **increase its force of impact four times**. If you triple the speed, the impact is nine times as great.
2. As crash speeds get very high, motorcyclist protective gear may not be able to keep the forces on riders/passengers below severe injury levels.

### **Not Wearing a Helmet**

Not wearing a helmet. What do you think? Does not wearing a helmet contribute to crashing? While it could be argued that both the wearing and not wearing a helmet could contribute to causing a crash we find no research evidence on this issue. So, our answer is “no. “ Choosing to not wear a helmet is not a cause of crashing.

The second question, however, “does failing to wear a helmet contribute to suffering an injury leading to death?” The answer is a resounding “yes.” Reviews of the literature regarding helmet use consistently conclude wearing a helmet contributes to reducing motorcycle crash-related injuries and deaths. The research evidence on the effectiveness of helmet use for preventing and reducing head and brain injury is overwhelming.

### **Without a valid license**

Here is the ride-along factor that is more difficult to analyze. We can clearly reduce motorcyclist fatalities by implementing countermeasures aimed at reducing alcohol impairment, reducing speeding and increasing helmet use. However, the impact of efforts aimed at increasing the percent of riders who are properly licensed is more complicated.

We know not having a valid motorcycle operator license is a ride-along factor so we know there is a correlation between not having a proper license and fatal crashes. But does not having a proper license contribute to causing the crash. Many think the answer is YES because they think having a proper license is an indicator of having the physical skills necessary to safely operate the machine. But this isn't necessarily the case. As a counterexample, Xu's (author Xu Simon) family doesn't follow this trend. Her mother's 1970 Oklahoma driver's license came standard with a motorcycle endorsement, which she maintained over 50 years through a grandfather clause despite having never

operated a motorcycle. Her brother, in contrast, had ridden on a permit in Texas for years with no incident. He just hadn't got round to completing the requirements to get his license.

A 1994 DOT brochure put it this way: *...most unlicensed riders lack the knowledge, training and experience necessary to pass a licensing exam - or ride safely on the street*" (DOT, 1994). This statement is in a brochure almost 30 years old and shows how easy it can be to assume a cause-and-effect relationship when there is no evidence to support the assumption.

By 2014 NHTSA had this to say in a report on driver licensing *"... being involved in a fatal crash while having an invalid license does not imply that either the invalidly licensed driver, or the fact that she or he had an invalid license, was the cause of a crash"* (NHTSA, 2014).

It took 20 years but the incorrect assumption was corrected.

The authors looked to the research and found nothing addressing this issue. While one often stated goal of licensing is to assure that motorcycle riders have the minimum skills needed to operate motorcycles safely, the practical effectiveness, for reducing crash risk, of motorcycle operator licensing, is not known. *There are no evaluations of whether increasing the proportion of motorcycle riders who are validly licensed reduces the number of motorcycle crashes.*

It is often concluded, without evidence, that not having a valid license contributes to causing the crash. The stated reason being because the person without a valid license does not possess the necessary skills. However, think about this. A person has a motorcycle endorsement and rides regularly. Does that person immediately put themselves at greater risk of a fatal motorcycle crash if they fail to renew their license when it expires?

Our answer to the first question, does not having a valid license contribute to the crash, is NO – not having a valid license is not a contributor to the crash

And our answer to the question is also NO. Certainly not having license cannot be a factor contributing to an injury causing death.

This is a tough one and more high-quality research may help tease out the nature of the correlation. The over-representation of unlicensed riders in the fatal crash statistics may be a symptom of high-risk behavior choices. The rider says to him or herself "a couple drinks won't hurt or I can handle 10 MPH over the limit or I know the law says I need a special license but I have been riding for 8 years without and have never been stopped." On the last point, contrary to impaired riding and speeding, there is no evidence that not being properly licensed has a causal relationship to the crash. It is simply a correlated ride-along factor.

Training and licensing are intertwined and the authors hope openly addressing this topic will stimulate serious discussion surrounding this ride-along factor

### **Previous Driving Violations**

Previous driving violations is a ride-along factors not often discussed and almost never used as a basis for possible countermeasures. The evidence indicates that riders involved in fatal crashes are

likely to have significant previous traffic violations.

According to NHTSA Traffic Safety Facts, May 2022, (DOT HS 813 306) “motorcycle riders involved in fatal crashes had the highest percentages of drivers with previous driving records as compared to other vehicle drivers. Motorcycle riders involved in fatal crashes were 1.3 times more likely than passenger car drivers to have previous license suspensions or revocations (20.5% and 15.8%, respectively).

It is obvious that previous license suspension or revocation can not be the cause of the fatal crash but this data demonstrates correlation between previous violations and the fatal crash. The authors think this ride-along holds potential for new countermeasures - targeted efforts to this population.

### **Summary and Recommendations**

This paper (1) described five factors (or variables) data analysis and research has identified as regularly associated with or that ride-along with fatal motorcyclist crashes (2) defined the meaning of correlation and cause and (3) discussed each of the five factors in that context

Here are the authors recommendations.

**Alcohol** - impairment is a significant factor in causing crashes. Enforcement efforts should be strengthened.

**Speeding** – speeding is a significant factor in both causing crashes and causing injury leading to death. Enforcement efforts should be strengthened.

**Helmet use** – Helmet use is a proven measure in reducing injury, severity of injury and death in the event of a crash. All rider helmet use requirements are the only countermeasure that has been proven effective by an abundance of high-quality peer reviewed research studies. Every state should have an all-rider helmet use requirement.

**Efforts to increase the percent of riders with a valid license.** In the absence of evidence or research connecting the lack of valid license to crash causation, it is possible these efforts on behalf of motorcyclist safety are wasted. The authors recommend motorcyclist safety program funded efforts to increase the number or percent of riders with a valid license be halted or significantly decreased. If enforcement agencies pursue efforts aimed at increasing the number or percent of riders with valid licenses this is a separate issue with no anticipated safety consequences.

**Previous driving violations.** This ride-along factor is often overlooked. The authors recommend motorcyclist safety programs get creative in designing countermeasures using this factor.