Nobody Told Me That Motorcycles Are So Dangerous

A paper on understanding the danger of motorcycling in the USA

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National Motorcycle Institute (NMI) is a
501(c)(3) Public Benefit/Charitable Non-profit Organization

MotorcycleInstitute.org

We use science to understand and manage the danger of motorcycling.

Introduction

Most people would agree that driving or riding upon a motorcycle on public roadways is dangerous. But the level of danger is much higher than most people realize. And the countermeasures that have been attempted over the past 40 years have not reduced the danger to an acceptable level. Well-known countermeasures including rider training, motorcycle licensing, and personal protective equipment have not reduced the danger.

Motorcycle Crash Fatalities are at disturbing levels. The countermeasure that works the best is encouraging people to opt out of taking up this recreational activity. People who have become curious about motorcycling should be made aware of the danger and the intense level of effort needed to become a serious motorcycle driver. Similar information must be provided to people who have become curious about riding as a passenger on motorcycles. This information also needs to be available to those who are in a position to influence them. For anyone concerned about the danger of motorcycling, either as a driver or passenger, the best answer is to opt-out once the danger is understood.

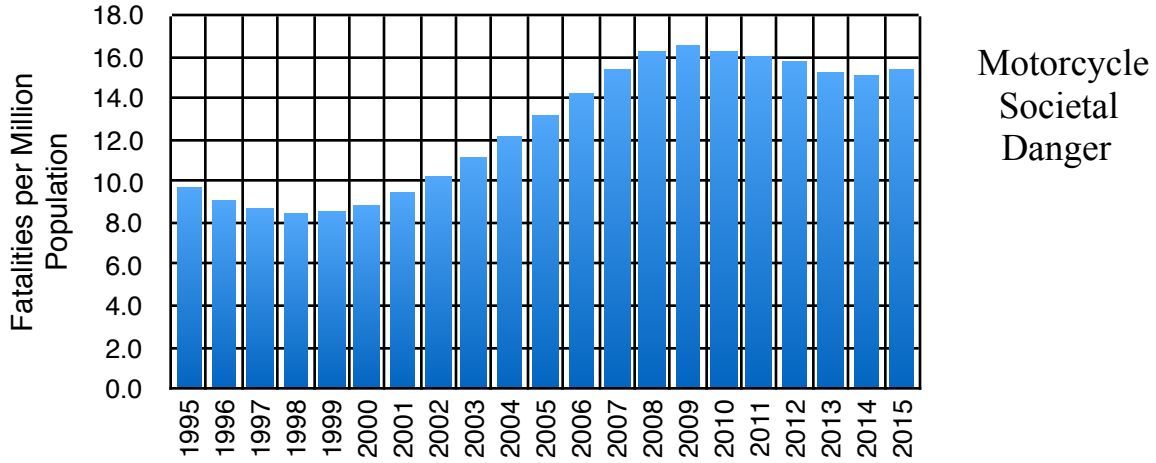
Please share the information contained in this document with anyone in a position to counsel a person who has become curious about motorcycling. The data contained here will support an explanation about being uncomfortable with their loved one's choice to pursue motorcycling on public roadways.

We are careful and precise with our terms when analyzing the danger of motorcycling on public roadways. There are three important data sets necessary to use when analyzing the danger: *Crash Fatalities per Population, Crash Fatalities by Person and Motorcycle Type*, and *Driver Fatalities per Driver (Vehicle) Miles Traveled*. All three data sets are necessary to accurately quantify the dangers of motorcycling. All data contained in this document are obtained directly from federal databases including the Fatal Accident Reporting System (FARS) to ensure that our statistics are accurate. We use terms that correspond to those in use by traffic safety professionals. There are definitions at the end of this paper.

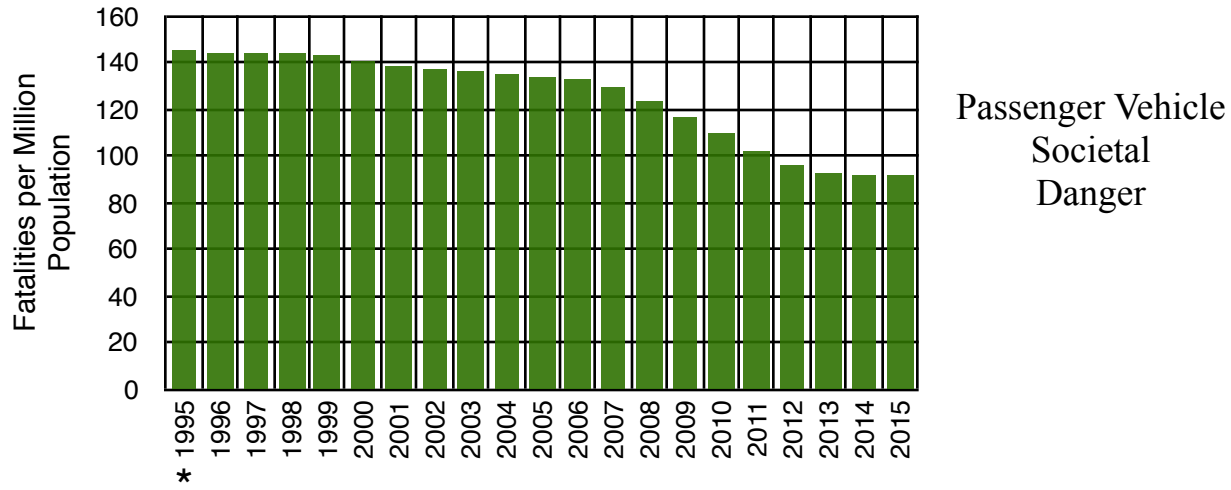
The societal danger of motorcycling:
We use *Crash Fatalities per Population* to model what we call the "Societal Danger of Motorcycling." The Motorcycle Crash Fatality per Population chart provides a way to gain a historical perspective on the changes to societal danger of motorcycling. This is a "participation" type of measure. We also provide the Passenger Vehicle Crash Fatalities per Population for comparison, which we call the comparison group. Currently there are about 15 motorcycle crash fatalities per million population annually. This is an alarming doubling of the motorcycle crash fatality rate of 20 years ago (a +100% increase). For passenger vehicles, the comparable rate shows an amazing decline of 35% (a -35% decrease)!

USA Crash Fatalities per Population
Five Year Rolling Average

USA **Motorcycle** Crash Fatalities/Population, (Everybody)



USA **Passenger Vehicle** Crash Fatalities/Population, (Everybody)



* Pre-1995 data not comparable, please see note under "Sources" below.

Who gets injured in motorcycle crashes:

The table "*Motorcycle Crash Fatalities by Person and Motorcycle Type*" provides insight into who receives fatal injuries in motorcycles crashes. The driver of the motorcycle is the fatally injured person more than 92% of the time! Also, the data in this table show that the two-wheeled street motorcycle, is by far, the dominant type of motorcycle involved in fatal motorcycle crashes (92% of the time it's the two-wheeled street motorcycle).

USA Motorcycle Crash Fatalities by Person and Motorcycle Type

2011-2015 Five Year Average

MC = MotorCycle	MC (Two-Wheeled Street)	Moped (motorized Bicycle)	Three-wheel MC Or Moped - Not All-Terrain Vehicle	Off-road MC (Two-wheel)	Other Motored Cycle Type (mini-bikes, pocket bikes)	Unknown Motored Cycle Type	Total for Row	Not riding on the MC(such as pedestrians killed in MC crash)	Total Fatalities (Everybody) in USA MC Crashes on Public Roadways
Operator of a Motorcycle-In-Transport	4,181	141	14	41	89	19	4,484		
Passenger of a Motorcycle-In-Transport	274	7	3	1	3	1	289		
Unknown Occupant Type on a Motorcycle-In-Transport	3	0	0	0	0	0	3		
Total Motorcycle Occupant Fatalities	4,457	148	17	42	92	19	**4,775**		
Non-Occupant								76	
Total Fatalities (Everybody) in USA Motorcycle Crashes on Public Roadways =									**4,851**

The danger of driving a motorcycle

To correctly measure the danger of driving a motorcycle, we use *Driver Fatalities per Driver-Miles-Traveled*. We call this the "Driver Danger." This is an "exposure" type of measure. We measure only drivers, which will allow a direct comparison to drivers of different types of vehicles. A driver is currently necessary to have a vehicle travel a mile (VMT). This means that VMT is equal to "Driver Miles Traveled" which is the correct way to quantify exposure to danger for the driver, rather than other data (such as vehicle registrations). Based on driver fatalities per VMT of exposure it is, shockingly, over 25 times more dangerous to drive a motorcycle than to drive a passenger vehicle, mile for mile! (See Footnotes for Occupant Danger)

USA Driver Fatalities per Driver-Miles-Traveled (=VMT)

2012-2015

	Motorcycle Driver Fatalities (MDF)	**Motorcycle Million VMT**	**Motorcycle Driver Fatalities per 100 Million VMT**
2012	4,652	21298	21.8
2013	4,423	20366	21.7
2014	4,318	19,970	21.6
2015	4,684	19,606	23.9
Total	*18,077*	*81,240*	*22.3*
	Passenger Vehicle Driver Fatalities (PVDF)	**All light Duty Million VMT**	**Passenger Vehicle Driver Fatalities per 100 Million VMT**
2012	15,842	2,664,445	0.595
2013	15,495	2,677,730	0.579
2014	15,431	2,710,556	0.569
2015	16,415	2,779,693	0.591
Total	*63,183*	*10,832,424*	*0.583*
	MDF per Million VMT	**PVDF per Million VMT**	**Relative Danger = (MDF /VMT)/ (PVDF/VMT)**
2012	21.8	0.595	36.7
2013	21.7	0.579	37.5
2014	21.6	0.569	38.0
2015	23.9	0.591	40.5
Average	*22.3*	*0.583*	***38.2***

It is **Over 25 Times more Dangerous** to Drive a Motorcycle than to Drive a Passenger Vehicle, Mile for Mile

Conclusions

All three data sets are needed to understand the dangers of motorcycling on public roadways. The motorcycle crash fatalities per population (Societal Danger) data set, has varied over time, and can be reduced. The level of participation in motorcycling is the primary cause of this rate rising or falling. The current rate of about 15 fatalities per million population can be reduced to below 8. For the USA, achieving this goal would reduce the current motorcycle fatality count from about 5,000 persons annually to about 2,500.

NMI's table of Motorcycle Crash Fatalities by Person and Motorcycle Type answers the questions about who gets injured in crashes. Clearly, motorcycle drivers of two-wheeled street motorcycles are the dominant persons fatally injured in all types of motorcycle crashes. This table also leads to answering the questions about whether properly licensed motorcycle drivers are involved less frequently in fatal crashes. When the FARS data base is checked for fatally injured motorcycle drivers properly endorsed for motorcycles operation, and their license is not suspended or revoked, the result is about 80%. (It is an astounding 90% when including drivers who have had a motorcycle endorsement, whether or not at the time of death, are not properly licensed because of license suspension or revocation.) When we combine the facts that endorsed motorcycle drivers dominate the fatality count, and that driving a motorcycle is over 38 times more dangerous than driving a passenger vehicle, we are led to the understanding that motorcycle driver endorsement does not reduce the danger to an acceptable level.

NMI's models also indicate that the motorcycle Driver Fatalities per Driver-Miles-Traveled (Driver Danger) rate does not vary significantly from year to year (except from changes in the formula for estimating VMT, which was last changed in Aug 2011). The driver fatality rate is now a relatively constant 22 per million VMT. After 40 years of motorcycle "safety" promotion and billions of dollars spent nationally, there is no indication that the motorcycle driver danger rate can be reduced from current levels (unlike the potential to reduce the current 15 motorcycle crash fatalities per million population, as mentioned above). We are confident with this conclusion. If we accept that the Driver Danger rate no longer varies, regardless of intervention tactics such as training and licensing, it would be appropriate to redirect resources to reducing the motorcycle crash fatality rate (the Societal Danger rate). **This can include better public awareness programs that educate the population on the extreme danger of motorcycling as well as adding opt-out counseling for successful students of current training and endorsement programs**.

When the three data sets contained in this paper are examined, state by state, another serious and uncomfortable trend is shown. Each state shows a dramatic increase in motorcycle crash fatalities whenever motorcycle "safety" training became popular, especially when the training was connected to motorcycle license testing. There is no exception. This leads us to the understanding that there is a strong inappropriate connection between promotion of motorcycle "safety" training and the promotion of motorcycling.

The data makes it self-evident that participating carelessly in a dangerous activity will increase the danger. However, it is NOT self-evident, although true and factual, that: *"Even when being careful, motorcycle drivers are experiencing great danger relative to driving their cars."*

Understanding the different danger measurements and focusing on the Societal Danger Rate is crucial. We realize that this is a major paradigm shift that "safety" professionals may have difficulty making. However, once this paradigm shift is made we will more easily direct our resources and efforts towards effective danger reduction.

This "shifting of paradigm" is analogous to shifting from the paradigm of the earth being flat, like a table, to the paradigm of the earth being spherical, like a ball. Prior to that paradigm shift, there were many people who could not comprehend concepts such as circumnavigating the earth, or the earth rotating to create night and day. The "flat earth" paradigm could explain individual observations, but could not explain other observations. Understanding the true situation requires an appropriate paradigm.

For those who are genuinely interested in reducing motorcycle crash fatalities we suggest this new paradigm, focusing on societal danger, when applying resources and efforts. When possible, please share the information and ideas contained here with your colleagues and friends. Most importantly, share this information with the mothers and fathers, spouses, significant others, and loved ones of those who are curious about motorcycles. We look forward to the time when more people adopt this new way of understanding. This will lead to a reduction of motorcycle crash fatalities and injuries on our public roadways. This will also lead to much less pain and suffering by people whose loved ones are killed and injured in motorcycle crashes.

We encourage you to:

Share and Promote the New Paradigm:
- Motorcycles are dangerous and can be enjoyable.
- Motorcycle drivers can get hurt or killed even when they are doing everything "right."
- Motorcycle drivers are similar to all other human drivers.

Reject the old paradigm:
- Motorcycles can be safe and enjoyable.
- Motorcyclists who get hurt were always doing something "wrong" or could have done something "more right."
- Motorcyclists can't be compared to other drivers.

Data Sources

Slide Presentation: "FARS Rosetta Stone - Understanding the FARS limitations to the data and help for translating terms"

Fatalities: NHTSA Fatality Analysis Reporting System (FARS) using the FARS File released September 2016

VMT, Vehicle Miles Traveled: Federal Highway Administration

Population: US Census Bureau

Footnotes:

Five-year averaging: We use five-year averaging to provide enough data points to smooth out random fluctuations. This will make comparisons to individual US States more reasonable. The 1995 five-year average is 1991+1992+1993+1994+1995 divided by 5. The five year average is then "rolled" forward to obtain the next year's average. Also, five year averages are commonly used by other organizations, such as NHTSA. Using five year averages makes checking and comparing the data in this document more accessible for the reader.

Start with 1991 Data: We start with the 1995 five year average because the FARS definition for "Passenger Vehicle" was changed to its current definition in 1991. The 1991 data is a part of the 1995 five-year average. Using earlier years will not be useful for comparisons. Also, vehicle, roadway, and data collection technologies vastly change over time periods greater than 25 years, which again limit the usefulness of many longterm comparisons. See FARS Manual and FARS Analytical User Manual for details.

Relative Occupant Danger: Drivers are occupants. This requires that, scientifically, the relative occupant danger must be similar to relative driver danger. You can obtain occupant-miles-traveled (also called "Person-Miles-Traveled" by FHWA) by multiplying VMT by the occupancy rate. Then you may obtain the occupant per vehicle-mile fatality rates for vehicle body types. Sometime a relative per vehicle rate is given, such as the 2014 NHTSA 27 times more Motorcycle Occupants killed per VEHICLE-mile. The reason the relative occupant per occupant mile ratio is greater than the occupant per vehicle mile is because cars have more seats, and thus more occupancy, than motorcycles.

Definitions and terms

Vehicle-In-transport: A vehicle being driven on a public road. Example: a motorcycle being driven on the street, not parked or being carried on a trailer.

Crash: A crash is any mishap that involves one or more vehicles-in-transport on roadways commonly used by the public. A Motorcycle Crash is a crash involving one or more Motorcycles-In-Transport on a roadway commonly used by the public.

Everybody: "Everybody" fatally injured in the crash is counted, whether riding, or not riding, on or in a vehicle-in-transport. Examples of those fatally injured in a motorcycle crash but not riding on a motorcycle-in-transport are pedestrians, road workers, pedalcyclists, and passenger-vehicle occupants. Everybody is a part of the "Population." This is why dividing the total fatality count in the crash by the population is a correct pairing of data to obtain a "proper rate."

Driver: The occupant operating or controlling the Vehicle-In-Transport. "Motorcyclists" include both drivers and passengers, also known as occupants, riding on Motorcycles-In-Transport. The Motorcycle Driver is the person operating the Motorcycle-In-Transport.

Passenger: A person being carried in or upon a Vehicle-In-Transport, who is not operating or controlling the vehicle.

Occupant: Anyone being carried in or upon a Vehicle-In-Transport. An Unknown Occupant fatality is a fatally injured person who could not be identified as the driver or the passenger, but was a fatally injured occupant in the crash.

Two-Wheeled Motorcycle and Sidecars: FARS definition Element Body Type 80 includes two-wheeled motorcycles with sidecars. In FARS counts, the small number of fatalities resulting from two-wheeled motorcycles with sidecars attached is included in Two-Wheeled counts and not Three-Wheeled Motorcycle (Body Type 82) counts.

VMT: Vehicle Miles Traveled, Driver Miles Traveled, Occupant Miles Traveled

Currently, there is one driver per vehicle. This means that "Driver Miles Traveled" is equal to "Vehicle Miles Traveled." Next, to obtain "Occupant Miles Traveled," one multiplies VMT by the occupancy rate, which is always equal to or greater than 1. Thus, "Occupant Miles Traveled" is always equal to or greater than "Vehicle Miles Traveled" and "Driver Miles Traveled." In other words, there are more occupants than vehicles-in-transport or drivers. This is why dividing the driver fatality count in the crash by the VMT is a correct pairing (units) of data to obtain a "proper driver danger rate."

Once the Driver Danger rate is obtained for different vehicles, then relative danger ratios can be compared. Relative Driver Danger Ratios are a very good approximation for the Relative Occupant Danger Ratios since drivers are the majority of occupants, and the relative danger of all occupants are of a particular vehicle are similar. This means that it is also over 30 times more dangerous to be an occupant of a motorcycle than to be an occupant of a passenger vehicle, mile for mile.

Currently it is accurate to set Driver Miles Traveled equal to Vehicle Miles Traveled. As autonomous (or driverless) vehicles become more prevalent, the Driver Miles Traveled will become not equal to Vehicle Miles Traveled. For motorcycles, Occupant Miles Traveled can be approximated by Vehicle Miles Traveled. For passenger vehicles, it has not, is not, and in the future will not be accurate to set Occupant Miles Traveled equal to Vehicle Miles Traveled.

Due to changes in the way VMT has been calculated in the past, current VMT cannot be compared to VMT from previous decades. Both the FHWA and NHTSA have posted warnings to not use registrations or VMT for historical comparisons. After reviewing the materials available, we have confidence in using VMT beginning with 2012.

The validity of VMT can be checked by counting cars and motorcycles on public roads. Start by just counting the passenger vehicles between motorcycles. The average motorcycle to passenger vehicle VMT ratio is about 1 motorcycle to 130 passenger vehicles.

Verifying that motorcycles are only about one out of every 130 vehicles on the road helps quantify the danger of motorcycling. One out of 130 is much less than 1% of vehicles on the road, but motorcycle fatalities represent more than 20% of all driver fatalities.

Further Information and Reading: Please visit **MotorcycleInstitute.org**

National Motorcycle Institute (NMI) is a 501(c)(3) Charitable Non-profit Organization committed to reducing the fatality and morbidity rates of motorcycle drivers and passengers. We use science to understand and manage the dangers of motorcycling.