

NORMA FARIS HUBELE



BACKSEAT DRIVER

The Role of Data in
Great Car Safety Debates

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A CHAPMAN & HALL BOOK

Backseat Driver

Buying the safest car for your family shouldn't be up for debate.

Yet for decades, car safety advocates, manufacturers, and lawmakers in the United States have clashed over whether to make automobiles safer. All sides armed themselves with data in the hopes of winning the great car safety debates. In this way, crash statistics and the analysts who studied them made history. But data were always in the backseat, merely supporting different points of view. That is, until now.

With car safety, it's the value we place on every human life that counts.

Automobile safety expert Dr. Norma Faris Hubele delivers a lively discussion of the role data play in protecting you and your family on the road. You'll gain a greater appreciation for how:

- A World War I pilot's near-death experience birthed the U.S. car safety movement
- Data from real car crashes helped create the first vehicle safety standards
- A shift toward fuel-efficient cars affected fatality risk in the 1970s–1980s versus now
- Vehicle size has changed, and the problems that creates for you and others sharing the road
- Car safety rating systems, even when limited, empower consumers and motivate manufacturers
- Federal regulators decide whether to issue a safety recall on your vehicle
- Data's role is evolving with the advent of driver-assist and self-driving technologies

Norma Faris Hubele, PhD has served over 30 years as a professor, consumer advocate, and automotive safety expert. She was the first director of strategic initiatives at the Fulton School of Engineering at Arizona State University, where she is now a Professor Emerita. An expert witness in over 120 car safety cases, Dr. Hubele has educated the courts about when statistics can or cannot inform decisions. She is a co-author of a widely used textbook, *Engineering Statistics*. Dr. Hubele is founder and CEO of TheAutoProfessor.com, a free website for new car safety ratings and information.

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The Role of Data in Great Car Safety Debates

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Introduction

In closing, let me emphasize that more than 100 people die on our highways every single day. In our view, one death is too many. We must change a culture that is willing to accept those losses, and we need your help to implement proven solutions.

—JENNIFER HOMENDY (2019)¹

Tommy, 4 years old, died in a fiery car crash in March of 2012. He was secure in a child safety seat in the back of his family’s 1999 Jeep Grand Cherokee. His older cousin, Sally, was driving him to tennis class when a driver, high on cocaine, plowed into the rear of their SUV.

The fire, fueled by the Jeep’s rear-mounted gas tank, spread so fast and violently that nobody could help Tommy escape. Sally was uninjured, as was the driver who caused the crash. If not for the fire, Tommy only would have suffered a fractured leg.

Fourteen years before this crash, a mother wrote a prophetic letter to Jeep’s corporate offices about her daughter’s harrowing escape from one of their vehicles.

Within moments the Jeep was on fire because the gas tank had been hit. The driver’s door was already in flames when she jumped out of the car. However, in thinking about it afterwards, I can only imagine how horrible a situation it would be if a driver had

to remove a child from a car seat or could not get out of the car within moments.

The mother was among many who voiced their concern about Jeep's design decision to place the gas tank behind the rear axle, where it is vulnerable in rear-impact crashes. Comparisons were drawn between the Grand Cherokee and the infamous Ford Pinto with its rear-mounted gas tank, which caused violent passenger deaths and led to a recall in the 1970s.

At the time of Tommy's death, the 1999 Jeep Grand Cherokee was under scrutiny by the Office of Defects Investigation (ODI) at the National Highway Traffic Safety Administration (NHTSA). This office handles vehicle recalls related to safety. They were investigating fuel tank failures and vehicle fires in rear impacts. The ODI had studied fatal crash statistics and determined that Jeep vehicles had a higher incidence of fatalities in these types of crashes than other similar size vehicles.

On June 12, 2012, the ODI raised their investigation to the status of an Engineering Analysis. Three types of Jeeps with rear-mounted fuel tanks were edging closer to a recall: Jeep Grand Cherokee (model years 1993–2004), the Jeep Cherokee (1993–2001), and the Jeep Liberty (2002–2007). The ODI asked the Chrysler Group – Jeep's corporate organization – to respond.

Analysts working for Chrysler challenged the ODI's findings. Using different statistics and comparison vehicles, these analysts argued that the Jeeps had better overall safety records than other comparison vehicles. In fact, their vehicles met or exceeded all applicable Federal Motor Vehicle Safety Standards. In addition, there were plenty of other vehicles, past and present, that had worse fire rates and had never faced a recall. And notably, the Jeep fires occurred in severe, high-energy rear impacts.

Personal tragedy spurs car safety debates. Tommy's death was one of those tragedies. That's where the data come in. The data are the "counts." How many deaths? How many injuries? How severe? To some decision-makers, the data show a problem. Others argue that there are miscounts. A different way of counting reveals no problem.

Numerous factors influence decisions in car safety. The stakes in lives, money, political capital, and brand reputation are very high. It's not surprising that in the public arena, each side seeks to use data to make their case.

Ultimately, a decision is made. The ODI issues a recall. A jury issues a verdict. A carmaker changes a vehicle design. Did the data make the

difference? Or, was it the bad publicity? The high cost of law suits? Changes in customer preferences? Or, was it just the right combination of all of the above? In truth, we never know for certain what tilted the scales.

The ODI ended its investigation into the Jeep-brand vehicles on November 14, 2014. In doing so, it accepted Chrysler's proposal to install a hitch receiver, or tow hitch, on 1993–1998 Jeep Grand Cherokee and 2002–2007 Jeep Liberty vehicles. Laboratory testing of rear impacts with these hitches provided enough evidence for the ODI to conclude that the remedy had “incremental safety benefits in certain low- and moderate-speed crash incidents.” Chrysler's data analysis even convinced the ODI to exclude Tommy's 1999 Grand Cherokee in the recall. In the document ending their investigation, the ODI wrote:

Examination of the available data established that the MY [model years] 1999–2004 Grand Cherokee did not pose the same magnitude of safety risk as the MY 1993–1998 Grand Cherokee and MY 2002–2007 Liberty, particularly in low- and moderate-speed rear impacts.

Chrysler no longer builds vehicles with rear-mounted gas tanks.

FRAMING THE DISCUSSION

Since this book is about using data to make our cars safer, it seems natural to start with some simple questions. When did the United States start collecting in-depth data on car crashes? What motivated it? Who did the collecting? What form did it take? How did that collection evolve to the present-day databases of information on millions of crashes?

To answer these questions in detail is beyond the scope of this book. However, I set the stage for our discussion by including a few historical highlights in the following two chapters. You'll see how key people and public attitudes shaped what was happening in the early- and mid-20th century, leading to our present treasure trove of information.

I begin with a look at the early days of the automobile. Road deaths and injuries rose sharply and details about these crashes were lacking. Most people dismissed these tragedies with a “too bad” type of attitude, and the public usually blamed the drivers. The prevailing view was that these crashes were simply the cost of modern transportation.

In the mid-20th century, attitudes started to change. A group of doctors, statisticians, and engineers carefully compiled evidence that showed

some injuries and fatalities could be prevented with proper car design. As a society, we might not be able to prevent all crashes, but we could possibly reduce or mitigate injuries in a crash by making vehicles safer.

Safety advocates began to ask key questions about what could be fixed in cars. Today, cars in the United States must meet more than 40 federal standards to ensure safety. These include padded dashboards, collapsing steering columns, seat belts, airbags, and better door locks, just to name a few. Safety experts credit these standards with saving over 620,000 lives since 1960.

But there was much debate leading up to this progress. In the remaining chapters, I describe some data-intensive controversies that accompanied these gains. These examples shine a light on the analyses performed at the NHTSA. This division of our federal Department of Transportation has a mission to save lives, as well as reduce injury and property damage on our roadways.

NHTSA uses data to carry out its mission, whether it is creating new standards, updating old ones, deciding on recalls, or rating the safety of our cars. And so, do its opponents. These data-driven debates are the focus of this book. How, when, and why different datasets and types of analyses are used to determine, ultimately, the type of cars we get to drive.

The data discussed in this book are not complicated. Simple graphs and tables capture the core elements of the disputes. If you want to find the sources for the data in the tables and graphs or you want to go deeper into the discussions, the **Further Reading** for each chapter will provide you with a starting point. However, you don't need a college-level course in statistics to read this book. You only need a curious mind and an appreciation for debating vital issues facing our society.

THE DEBATES

It would take volumes to cover all the great debates in car safety. Instead, I chose a set of prime examples to illustrate data's role in some of the most intense disputes among lawmakers, safety advocates, and carmakers.

The chapters use elements of real-life stories to illustrate a controversial topic in car safety. For example, I discuss Tommy's tragic death and Jeep's argument for the rear-mounted fuel tank in the context of the recall debates in [Chapter 9](#). In another recall dispute, I show how one owner's complaint was part of the investigation of unintended acceleration allegations in Tesla vehicles. In another chapter, a story about a fellow's death in a rollover crash demonstrates how heated the public debates around

federal safety standards can be. The back and forth between sides can get tedious, but the main message is clear. Each side is certain that their analysis is the right one. In the end, the federal administrators must make a decision.

Sometimes, the car safety problem discussed in a chapter needs a lot of context. You'll see that in the chapter on the fuel efficiency debate. Here, I describe the Corporate Average Fuel Efficiency (CAFE) standard before I explain the role of data in the debate. Over the past 30 years, this story took some twists and turns. Environmentalists wanted higher targets for miles-per-gallon, while industry leaders wanted less regulation. Passions ran high. As you will see, at each junction in the road, these competitors armed themselves with data to support different points of view.

In the final chapter, I talk about self-driving cars. These high-tech vehicles vow to remove human error from our roadways, thus saving lives, injuries, and property damage. Their makers suggest that these vehicles are all about safety. And where does data play a role? Everywhere. Data are used to create these robots and test them. Data are used to proclaim these futuristic vehicles are ready to hit the road alongside you and me. And data are used to block their deployment as well. Society is moving toward a future in which data are no longer in the backseat advising – the data are behind the steering wheel driving. Carmakers are investing billions of dollars in the promise of these autonomous vehicles. It's no wonder that the debates are so fierce.

In each chapter, I make a concerted effort to give you an objective view of the debate. However, early reviewers of this manuscript thought you also might like to have my personal take. To this end, I added a section called **Note From the Author**. Here, I give you my opinion about what transpired in the debate and my thoughts about the outcome. These opinions are based on my personal knowledge of these car safety issues. They reflect my experience as a statistician for over 30 years; as an expert witness in over 120 car safety cases; as a university professor teaching student engineers; and now, as founder of TheAutoProfessor.com, a free website that uses data to help families choose safer vehicles.

THE VALUE PROPOSITION

This is a book about data and social progress. The subject matter is car safety, but the principles are common across our society. As a democratic, pluralistic country, we are accustomed to debating important issues at the national level. The arguing may be about vaccination rates, immigration, or infrastructure repair. The purpose of these public discussions is

to gather information, consider different points of view and, in the end, to reach an informed decision. Today, data are used by all sides.

For many of society's problems, there is no universal way to look at the data. This makes for intense debates. And, what if there are no data or not enough data? Decisions still need to be made. The examples in this book illustrate these situations.

Finally, as a statistician, I am passionate about collecting and analyzing the best data available. But I am also committed to never losing sight of what's behind the data. I humbly use elements of real crashes, such as Tommy's, to remind us that human tragedy is always behind the numbers when talking about any social problem.

My hope is that when you finish reading this book, you will have a new appreciation for the role of data in safeguarding the lives of your family, friends, and neighbors. When it comes to car safety, in particular, and social progress, in general, it's the value we place on every human life that counts.

NOTE

1. Homendy, Jennifer. (2019). *Every life counts: Improving the safety of our nation's roadways*, U.S. House of Representatives subcommittee on Highways and Transit, 116th Cong. (2019) (testimony). <https://www.govinfo.gov/content/pkg/CHRG-116hhrg36978/html/CHRG-116hhrg36978.htm>. At the time Ms. Homendy gave this testimony, she was a member of the National Transportation Safety Board. On August 13, 2021, she became chairperson.

A Strange Start for a Movement

What is the human being but a lump of mush – protoplasm – sixty percent water ... What a contrast to the car itself. When you suddenly stop a rapidly moving car, so that the protoplasmic passenger, obeying the second law of Newton, continues on, his protoplasm spatters. The problem, then, is to protect mush against sudden impact.

—EDITORIAL (1937)¹

Hugh DeHaven didn't expect a lucky break. He was falling 500 feet in a plane that was spinning and approaching the ground very fast. He expected to die.

It was 1917, on the last day of DeHaven's flight training in the Canadian Royal Flying Corps. As a kid from Brooklyn, DeHaven had crossed into Canada and volunteered after the U.S. Army Air Corps rejected him a year earlier. Now he was close to his dream of becoming a pilot. But a reckless young trainee interfered by deciding to practice gunnery on the tail of DeHaven's plane. The result was a mid-air collision.

DeHaven lost part of his plane's wing and tail. No recovering from a fatal blow. Both planes crashed into the ground. DeHaven was the only one to survive.

His colleagues called him lucky. His superior officer called it the "Jesus factor." DeHaven, who had a degree in mechanical engineering, never

accepted any of these explanations. He had six months in recovery to think about what happened. His worst injury in the crash came from the seat belt buckle. DeHaven said the force from the crash threw his body forward and onto the stiletto-shaped buckle, which ruptured his pancreas. He felt confident that if he had escaped the abdominal injury, his hospital stay would have been only about one month.

After his recovery, DeHaven worked as a clerk collecting the bodies of deceased pilots after they crashed. That experience added to his observations about the causes of injuries. Some of these crashes looked survivable, if not for the pilot's head hitting the instrument panel or the wall of the cockpit. [Figure 2.1](#) illustrates the type of control panel that DeHaven would have critiqued. He studied how these tragic endings could have been avoided. DeHaven didn't know it at the time, but he was laying the foundation for a new field: the epidemiology of vehicle accidents. And one day, he'd be known as the Father of Crashworthiness Research.

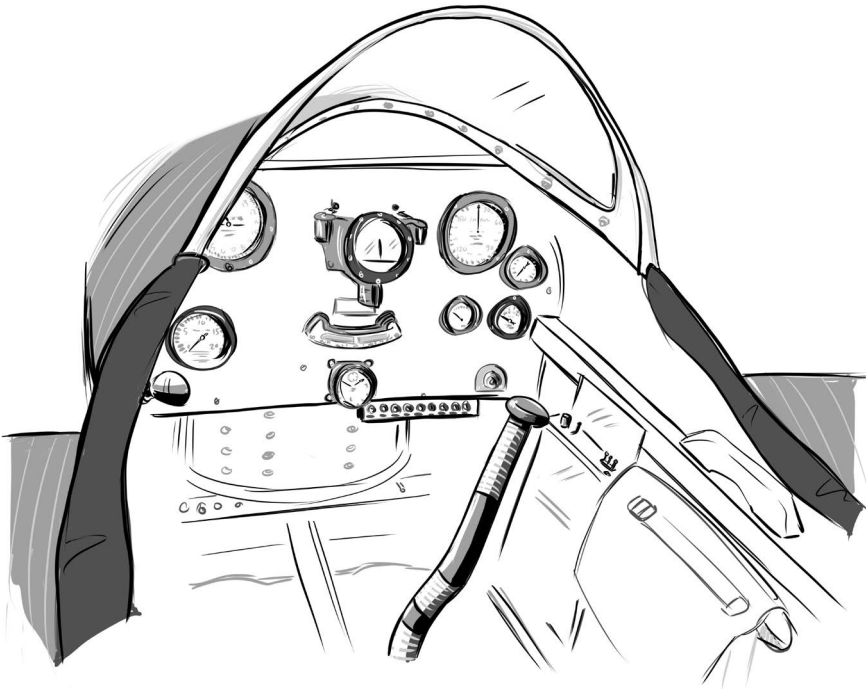


FIGURE 2.1 Illustration of an airplane cockpit circa 1917. DeHaven recognized the protruding dials and sharp edges as safety hazards in a crash.

A REALIZATION

Nearly 20 years after his plane crash, DeHaven witnessed a car crash back in the United States. The driver lost control when his car skidded on a wet road, flipped over, and landed in a ditch. He was not speeding.

The unrestrained driver flew forward and to the right. His head hit the knob for operating the windshield wiper. The sharp steel knob gouged through his right sinus, across his nose, and into the area above his left eye. The injuries should have been minor, but instead they were dangerous, leaving the driver disfigured and disabled.

Recalling this event as a turning point in his life, DeHaven wrote:

I again realized that engineers didn't know – and that nobody knew – how many times people were hurt or killed by things that could be easily changed. I had seen identical injuries in airplanes and I naturally wondered whether 10 or 100 or 1,000 people had been thrown against similar knobs in automobiles, and whether using a rubber knob would have eliminated their injuries.

Still working among pilots and engineers, DeHaven advocated to improve the safety of planes. Older pilots rebuffed him with statements such as, “If you can't face the dangers of flying, then stay on the ground.” Yes, they recognized that the pointed buckle on the pilot's safety belt was quite dangerous. But the belt was only meant to hold a pilot in place during inverted maneuvers. Any smart pilot, if he had time before a crash, would have taken the belt off.

Others mocked his ideas for building a safer cockpit. They'd say, “Sure, we'd be safer in accidents if we beefed up structures and lined the cockpit with mattresses. But that would cost weight and money. We could make planes safer, but we'd never get them off the ground.”

DeHaven needed good, reliable data that would not be dismissed. If a pilot survived, he had to be able to clearly show the scientific reasons why. The data had to be undisputable.

With his engineering background, DeHaven understood the idea behind forces on falling objects. A pilot and plane falling from the sky would be subject to these forces. However, these were complicated events with missing data. How high was the plane at the start of the descent? Which forces acted on the plane during the descent and to what degree? What was the pilot's movement within the cockpit during the crash? Even if he could generate estimates, DeHaven knew that his data would be hotly debated and probably rejected.