Zendrive crunches 30 billion miles of smartphone data and works with Milliman to build one of the industry's strongest predictive models

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Increase in crash frequency and driver fatalities

A report by the National Safety Council (NSC), a non-profit organization whose mission is to eliminate preventable deaths, estimated that 40,200 people died in motor vehicle crashes in 2016. This represents a 6% increase over the previous year, and the first time since 2007 that the number of deaths exceeded 40,000.

The rise in fatal crashes reverses decades of declines in the number of driver fatalities—declines that were largely attributed to safety measures like seat belts, air bags, anti-lock brakes, rearview cameras, and other safety improvements. While a recovering economy and lower gasoline prices have brought more drivers back onto the roads and allowed them to travel greater distances than during the preceding recession, these explanations fall short of the fact that the number of deaths per mile driven is also rising.

As more and more drivers use smartphones to talk, text, navigate directions, email, and perform a wide variety of other functionalities while driving, concern over distracted driving's contribution to climbing road collision rates has also increased. These types of smartphone distractions along with others like eating or reaching for an item on the floor are responsible for more than 3,000 deaths and 400,000 injuries each year, according to the Centers for Disease Control and Prevention (CDC). A National Highway Traffic Safety Administration (NHTSA) study identified dialing a handheld device as a driving behavior which more than triples the odds of getting into a crash.

Perhaps not coincidentally, the increase in driving fatalities has occurred at a time when many auto insurers have seen an increasing frequency of severe crashes, higher mileage, and rising medical costs. Coupled with competitive pressures, these changes are conspiring against commercial auto insurers. The U.S. commercial auto insurance market posted a combined ratio of 110.3% in 2016, a 15-year high and the sixth consecutive year in which the combined ratio exceeded 100%.

Could using data about actual driving behavior rather than relying solely on traditional commercial auto underwriting and rating techniques help identify what is causing collision rates to increase?

First-generation driving behavior data collectors

Past technology-based efforts to understand collision risk have focused on usage-based insurance (UBI) hardware-based telematics devices that are plugged into a vehicle to track the motion of the vehicle as well as vehicle performance, location, and maintenance. This first-generation data was enhanced with external third-party data to compute behaviors like speeding, highway driving, night driving, hard braking, annual mileage, and other ways the car is driven. UBI telematics scores help differentiate between risks that otherwise would be rated the same way as they were in the past, using traditional rating variables like age, gender, and territory. Many personal lines auto insurance companies have introduced telematics scores into their pricing algorithms to allow for more granular rating by considering individual driver behavior. A notable leader in the category, Progressive Insurance, collected 15 billion miles in 18 years of investment in this strategy. However, commercial auto insurance companies have instead responded to deteriorating profitability with broad-brush measures such as base rate increases, fleet-level schedule rating, and re-underwriting. Part of their reluctance to use telematics has been the high cost of the hardware-based devices.

New-age technology data collectors

More recently, telematics has expanded to include smartphone apps that use sensors and algorithms to measure driving behavior. Because more than 90% of crashes can be attributed to human error, this has massive potential as a data collection point. Smartphones have the ability to detect human behavior such as entry and exit into the vehicle and identification of the driver versus passenger as well granular phone use information. Smartphones even have the ability to communicate with other smartphones in the same or nearby vehicles.

One technology startup, Zendrive, formed in 2013 by a group of Google and Facebook alumni, built a mobile developer platform which is integrated into mobile apps and popular consumer applications. Zendrive, a recent winner of the Frost & Sullivan UBI award, captures driving behavior from millions of professional drivers and commuters. This includes the "traditional" factors collected by first-generation UBI hardware-based telematics devices as well as factors derived from information that only smartphones can measure. Zendrive's artificial intelligence platform detects vehicle trips and safety-related driving events using smartphone sensors like GPS, gyroscope, and accelerometer, and provides actionable insights intended to improve safety for passengers and drivers. Unlike traditional hardware-based solutions, this technique measures the driver's behavior rather than the vehicle's—a technique better attuned to measure human error, the number one cause of collisions. Within the past six months, Zendrive has amassed over 30 billion miles of data. This data includes risky driving events such as aggressive acceleration, hard braking, excessive speeding, and risky phone use, and combines them with risk-related data such as time of day, type of road, mode of transport, and any detected collisions.

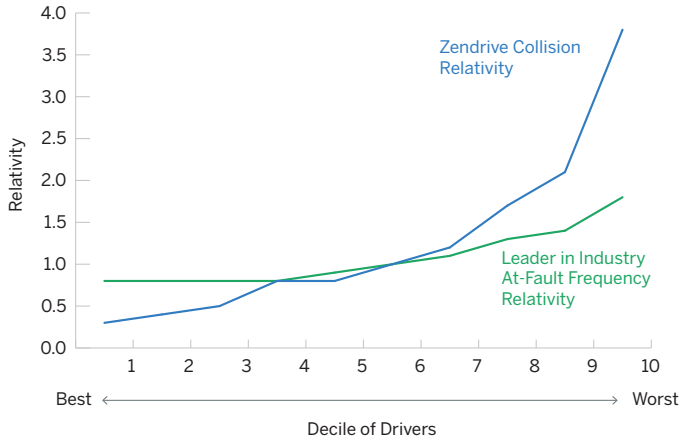
The information has a number of uses, especially for family members who want to monitor and encourage good driving behaviors among teens or fleet managers who can now target specific drivers for training and improve driving behavior in a highly individualized manner. For insurers, the information can also serve as the basis for developing precision-rating methodologies using specific determinants of risk that are closely linked to collision frequency rather than generalized factors.

A risk-based rating model

Using data collected by Zendrive, Milliman recently studied the impact of distracted driving and other driving behaviors on collision frequency. The study included data from over 3 million drivers with several billion total miles driven, which was collected from December 2016 through March 2017. Milliman created a risk score to predict the number of crashes per mile using each driver's behavior during the first 14 days of driving. We then looked at all collision events following the first 14 days of driving.

Each risk score considers the impact of driving behavior on crash frequency as well as the correlation between the various driving behaviors. Looking at these predictors in a multivariate fashion allowed us to see each driving behavior's contribution to the increase in collision frequency without double-counting the correlation between the various behaviors. For example, hard braking is a predictor in traditional telematics scores; additionally, a driver distracted by a smartphone would likely be prone to more hard-braking events. Analyzing these two driving behaviors–hard braking and smartphone use–in isolation of each other could result in double-counting. This pitfall was overcome with a multivariate model that combined several driving behaviors and was found to be more predictive of crash frequency than traditional UBI telematics scores we have seen. Below is a chart depicting the relative difference in crash frequency per million miles by risk score decile.

ZENDRIVE WORKS WITH MILLIMAN TO DEVELOP A RISK SCORE TO SURPASS INDUSTRY LEADER



The highest decile of drivers for the Zendrive score has a collision frequency per 1 million miles that is 13.8 times more than the lowest decile of drivers. This lift is one of the strongest that has been seen in the industry with up to six times more predictive power than some industry-leading models based on traditional telematics data. It is difficult to compare lifts between the various models as they use different bases. Some use collision frequency and some at-fault collision frequency, while others use insurance loss cost or loss ratio.

Advancements in smartphone sensors have allowed mobile apps to detect driving behavior more accurately without the use of a hardware-based device. Smartphone-based information informs algorithms that are important for overall risk assessment, such as the ability to calculate and improve centripetal acceleration, driver-passenger identification, driver fatigue, distracted driving, mode of transportation identification, and increasing the accuracy of detecting collision events. For example, Zendrive's technology distinguishes between a hard-braking/rapid-acceleration event and a case of a smartphone simply falling to the floor. The technology also recognizes when a smartphone is in hands-free mode versus when the driver is holding the phone while driving. The inclusion of smartphone-based information not captured in traditional telematics data contributes to the increased predictive power of this model.

A higher volume of data and the "freshness" of the data also increases the predictive power of the data. Traditional U.S models have been based on crash data from 10 or 20 years ago to be able to amass sufficient volumes of data to create a telematics score. Older data is less relevant than data collected within the most recent year. Such a large, fresh dataset allowed for more granular analysis and a greater exploration of many combinations of behaviors while maintaining statistical credibility.

Adding insurance know-how to sophisticated analysis

Now that smartphone apps can track actual human behavior including distracted driving, there is an opportunity for commercial auto insurance companies to be early adopters of telematics to improve their ability to measure and rate risk. This opportunity could not come at a better time, when commercial auto insurance results have been deteriorating in the marketplace. As collision frequency does not consider what portion of those collisions were insured, the severity of each collision or the existing insurance company rate plan, there is an additional step before insurers can incorporate risk scores into insurance company rating plans. Before an insurance company can incorporate frequency-based models into its rating plans, it must consider tuning the rate relativity to integrate it with the existing elements of the rating plan. Milliman can lend its expertise to help an insurer integrate a risk-based score like Zendrive's into its rating algorithm. Once integrated correctly, smartphone-based telematics scores can be used to rate individual risks more accurately. The use of the smartphone-based telematics score goes beyond use in commercial auto rating. It can be used to improve driver behavior, which ultimately will reduce crashes on the road and save lives.

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