THE CORRELATION BETWEEN DRIVER PERSONAS AND CRASH RISK

REAL-WORLD DRIVER RISK PROFILING WITH TELEMATICS DATA

WHY READ THIS PAPER?

Agero's research covering billions of driven miles and thousands of crashes is delivering new insights into driver behavior and accident risk. Understanding this correlation will allow insurers, automotive manufacturers and others to better create the products and strategies needed to decrease risk, drive down costs and ultimately save lives. This paper dissects the data to create seven driver personas, identify their level of risk, and propose examples of the strategies that might impact likelihood of an accident.

BEHAVIOR DRIVES RISK

As automotive fatalities and claim costs continue to climb, understanding and measuring the correlation between driver behavior and crash risk has never been more important. If one can assess and quantify the impact of behavior on risk, it becomes possible to initiate steps to reduce that risk, and perhaps even eliminate some types of accidents before they occur. Fortunately, new mobile telematics research – data that is unprecedented in scope, volume and includes, most importantly, real-world crash validation – provides unique insights into the connection between the pattern of driver behavior (a driver's "persona") and the likelihood that behavior will result in certain types of crashes.

NEW DATA, NEW INSIGHTS

Measuring driver behavior and quantifying risk is central to Agero's mission of making roads safer. In December 2016 the company launched an innovative mobile app, MileUp®, to crowd-source the collection of smartphone-based driving data in order to validate lab crash test results

against real-world behavior. In a little over a year, 350,000 users drove more than 3 *billion* miles over 270 *million* trips. Per our MileUp white paper *Saving Lives with Mobile Crash Detection*, this data set has enabled Agero's data scientists to learn a considerable amount about how people drive including the patterns of behavior that most closely correlate with crash risk.

This vast MileUp data set contains information covering every trip that each of the users took while they were enrolled in the program. Perhaps more importantly, in addition to billions of miles of driver insight, the data includes several hundred reported crash events, complete with police reports, photographs, and testimonials. The dataset also covers thousands of additional crashes that were identified using the company's proprietary mobile crash detection technology.

This unique combination of real-world behavioral data and crash events provides an exciting opportunity to answer key questions about risk and how best to combat it.

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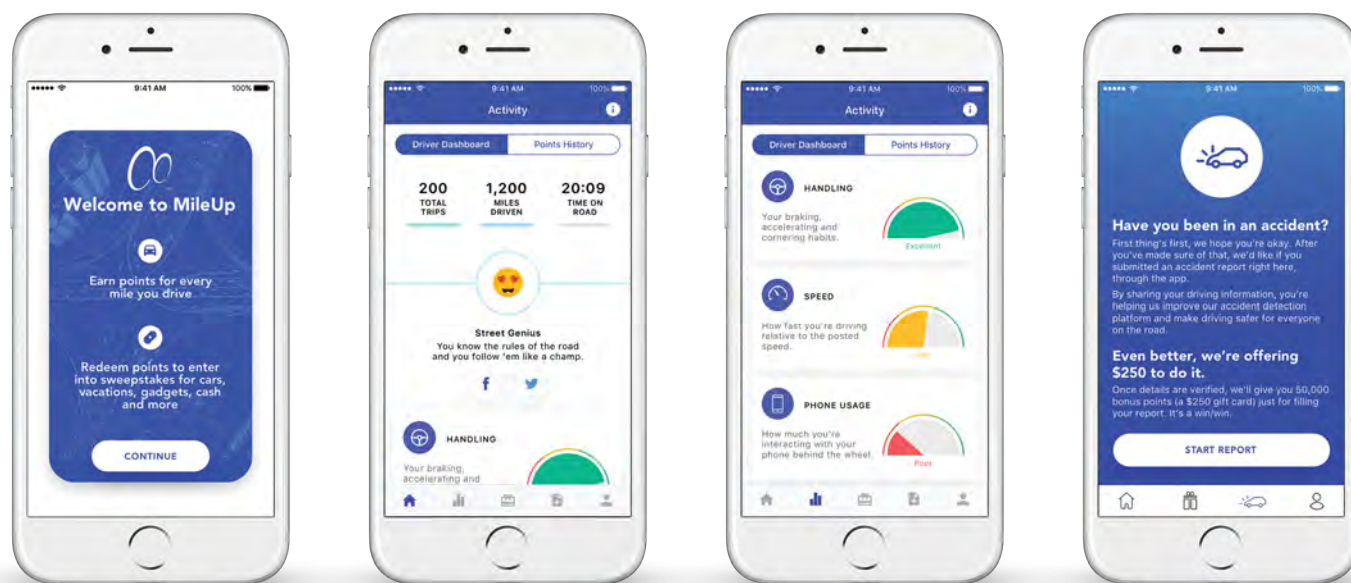
A TIMELY – AND CRITICAL – TOPIC

The skyrocketing incidence of distracted driving puts smartphone use among the hottest topics in policy, transportation and insurance circles – and rightly so, as we will see. Importantly for the topic at hand – and unlike weather, road conditions, traffic, etc. – smartphone use while driving is something that the driver directly controls. As such, our data scientists put considerable emphasis on understanding how people are using their phones while driving, and the corresponding implications for crash risk.

The data confirms what is already suspected: phone use while driving is all too common (Fig. 1). Although most users rarely if ever make calls (counting time using either the handset or a hands-free device), there are some that spend a considerable amount of their overall drive time

talking – up to 50% of drive time in the most extreme cases. Meanwhile, almost everyone manipulates their phones to some degree while on the road. That manipulation includes texting, reading email, browsing social media feeds, skipping to the next song on their media app, etc. On average the data shows that about 10% of drive time is spent manipulating the phone in some capacity.

Figure 1 – Distributions of phone call and manipulation rates for MileUp users
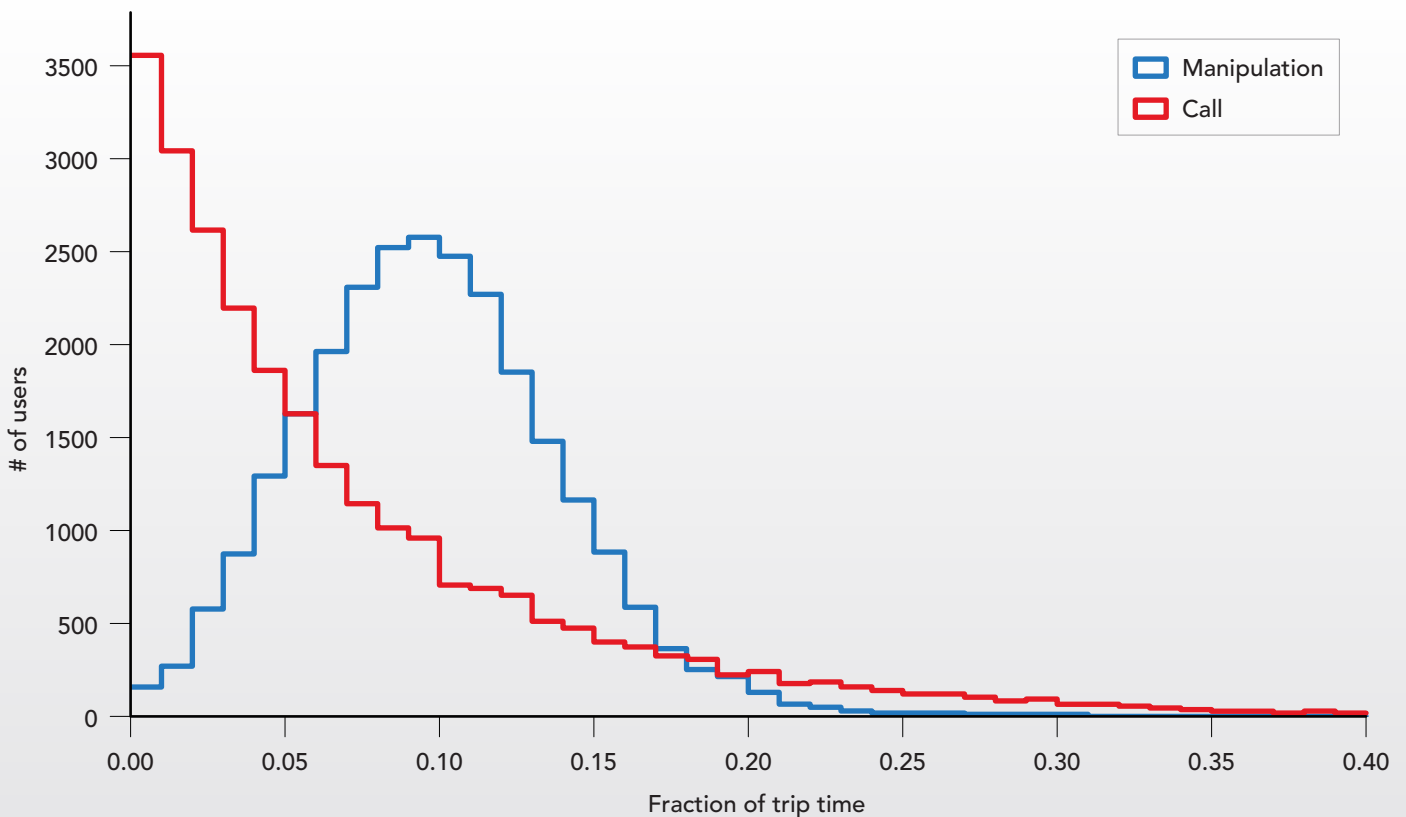
Source: Agero analysis of MileUp data

Figure 2 – Phone call and manipulation rates by age for MileUp users
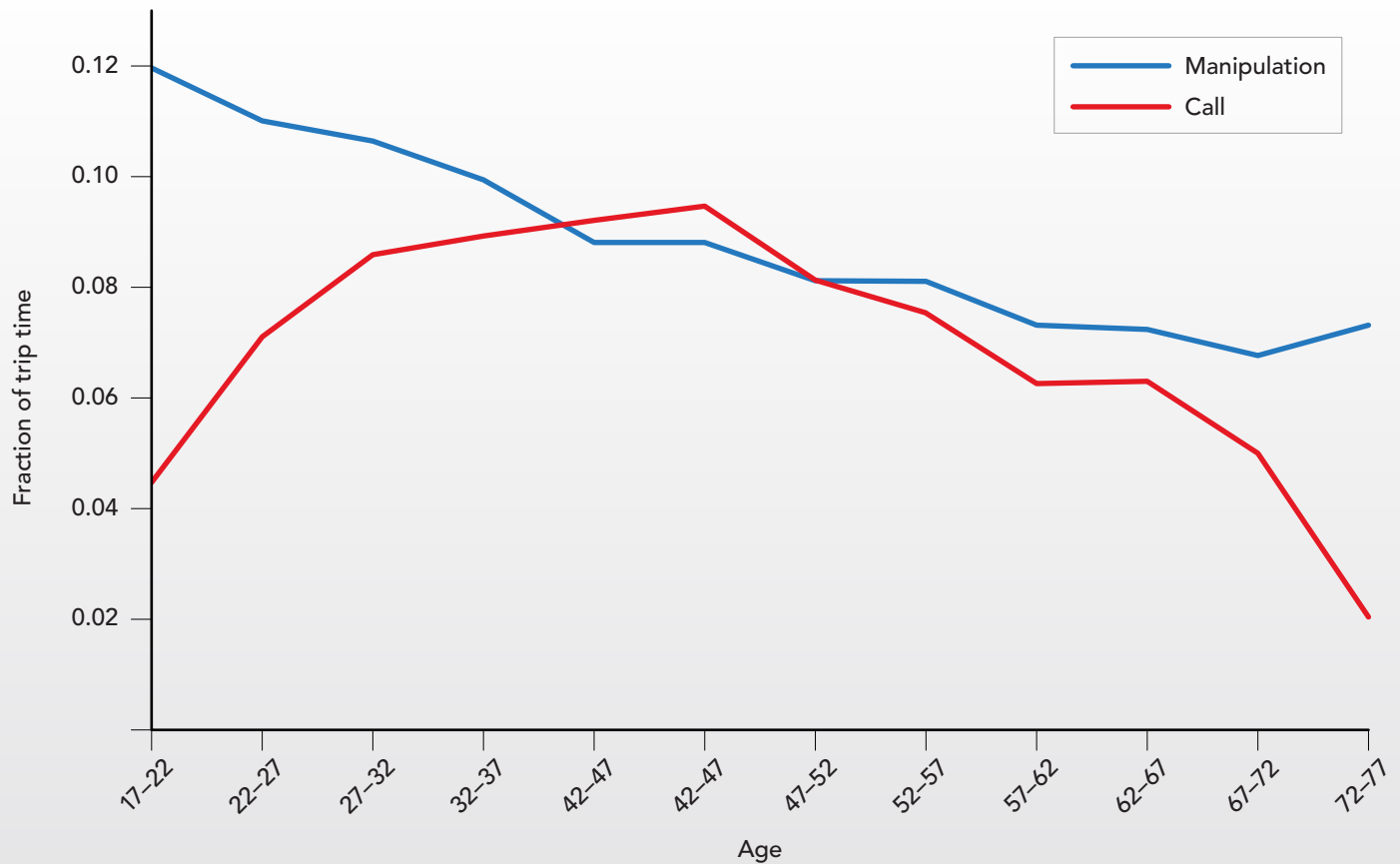
Source: Agero analysis of MileUp data

DIFFERENCES IN BEHAVIOR

Digging deeper reveals different usage patterns among different populations of users. For instance, Fig. 2 shows that phone use is generational. Younger drivers rarely talk on the phone, but are heavy users of other features that equate to manipulation. Middle-aged drivers actually talk about the same amount as they text – and tend to do both regularly. Meanwhile, older drivers tend to use the phone less in all capacities, although significant phone use is observed even among the oldest drivers in our population.

Phone use also varies by state. The Gulf states, for instance, all have among the highest rates of heavy phone users per capita (those in the top 10% by phone manipulation, i.e. those with nearly double the average manipulation rates or higher). Meanwhile, states on the West Coast have a relatively low proportion of heavy phone manipulators.

Interestingly, there is only a marginal impact from state laws prohibiting phone use. Phone manipulation is roughly 10 percentage points lower in states with an outright ban on all handheld phone use. While this is a step in the right direction, perhaps there are more effective ways to reduce phone use on the roads beyond hard-to-enforce laws.

Figure 3 – Fraction of MileUp users with the highest rates of phone manipulation by state.

Source: Agero analysis of MileUp data
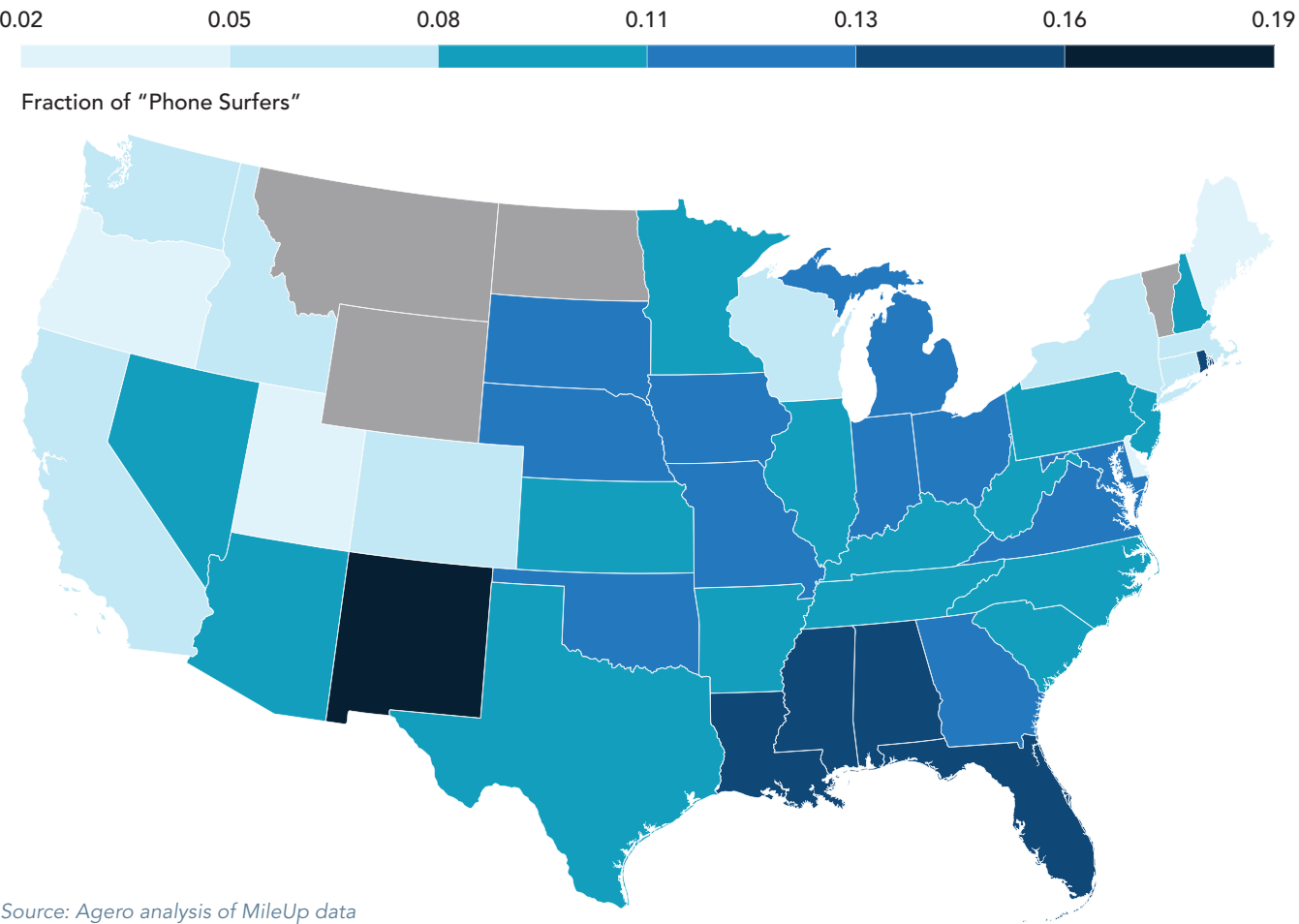
CORRELATING BEHAVIOR WITH RISK

Clearly, different user groups tend to display different behavioral characteristics, which isn't a notable insight. But by correlating driving behavior with crash data, it's possible to begin understanding the impacts of these different behaviors on safety.

Studies have shown that phone use while driving does impact crash risk [Dingus et al, 2016], although current naturalistic driving data is lacking. Yet given the rapid pace of change in smartphone capability and the dramatic growth in ownership rates, it is very likely that user behavior and risk factors have changed even in the last five years. The MileUp data set provides a unique opportunity to directly measure the current impact of phone use on crash risk at large scale.

In aggregate, the data shows that phone manipulation (and less so, call frequency) is highly correlated with crash risk. The plot below shows the observed crash rate for deciles of MileUp users, grouped by phone use-rates relative to the crash rate in the lowest decile. Drivers in the top 10% of measured phone manipulation had approximately 8 times the crash rate per mile driven, compared to the bottom 10% of phone manipulators. Meanwhile, users that spend a lot of time talking on the phone were 2 times more likely to crash compared to users least likely to talk while driving.

Overall, phone manipulation is the single riskiest behavior observed in the MileUp study, and poses a clear threat to public safety.

" THE MILEUP DATA SET PROVIDES A UNIQUE OPPORTUNITY TO DIRECTLY MEASURE THE CURRENT IMPACT OF PHONE USE ON CRASH RISK AT LARGE SCALE. "

Figure 4 – Relative crash rate for MileUp users in deciles of phone call and manipulation rates.
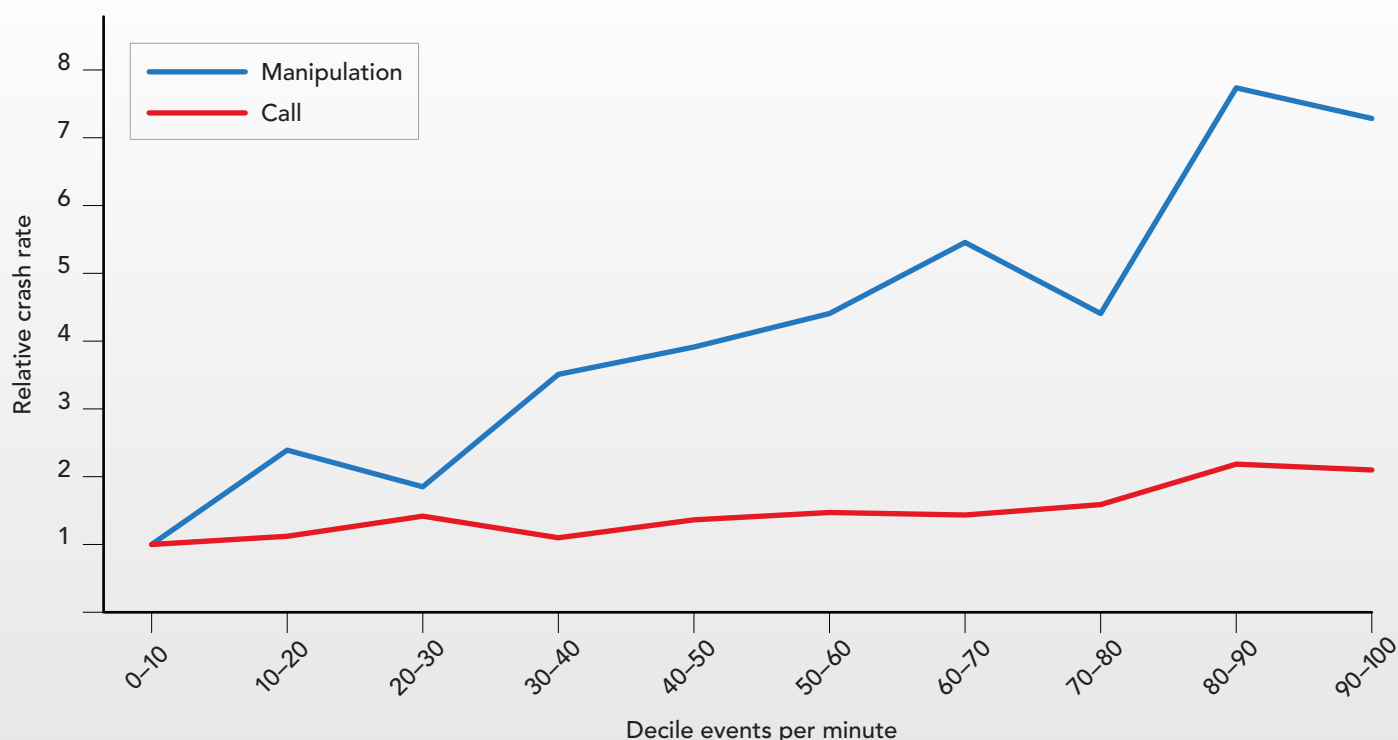
Note: Manipulation is any texting, reading email, browsing social media, skipping to the next song, etc.
Call is the frequency of phone calls, whether using the handset or hands-free devices.
Source: Agero analysis of MileUp data

Figure 5 – MileUp user personas.

	Model Citizens	Phone Surfers	Talkers	Red-light Readers	Traffic Texters	City Dwellers	Highway Cruisers
% of Population	12%	15%	21%	8%	5%	11%	12%
Average Age	**OLDER**	**YOUNGER**	**OLDER**	Slightly Older	Slightly Younger	Slightly Younger	**OLDER**
Crash Rate	**-47%**	**+76%**	-30%	-12%	+16%	+17%	-19%
Cruise Control	**HIGH**	**LOW**	Average	Average	Average	**LOW**	**HIGH**
Bluetooth	Slightly Low	Slightly Low	**HIGH**	Average	**LOW**	Slightly Low	Average
Rural vs Urban	Average	Average	Average	Slight Urban	Slight Rural	**URBAN**	**RURAL**

Source: Agero analysis of MileUp data

PATTERNS IN USER BEHAVIOR:
THE SEVEN DRIVER PERSONAS

With these findings in mind, Agero has identified seven different driver personas based on patterns in phone usage behaviors and factors related to speed. Looking at the demographics in each segment reveals interesting trends that help better understand drivers and what contributes to crash risk.

Each of the groups below represent a distinct non-overlapping segment of the overall driver population; inclusion in one group precludes inclusion in another.

"Phone Surfers" represent 15% of the population. These users are the heaviest phone manipulators. As a result, their crash rate is 76% higher than the average.

15%

"Model Citizens" represent around 12% of the population. These are the users with the lowest phone use overall, including both manipulation and calls. Thanks to their tendency to avoid using the phone on the road, their crash rate is half that of the average user.

12%

"Talkers" spend the most time talking on the phone while driving and represent 21% of the population. Despite the large proportion of time spent talking on the phone, their crash rate is 30% lower than average, perhaps because they tend to use hands-free Bluetooth devices at a high rate.

21%

"Red-Light Readers" are roughly 8% of the population. These are drivers that may manipulate their phones, but usually only do so while stopped in traffic. Although the manipulation rates for this group are moderate, their crash rate overall is still 12% below average.

8%

"Traffic Texters" comprise 5% of the population. They record moderate amounts of phone use at a wide range of speeds. As a result, these users have a 16% higher crash rate than the average driver.

5%

"City Dwellers" are users with relatively low average speeds and represent 11% of the population. These are urban drivers with typical phone use behaviors, but with much of their driving done in the city where crash risk is higher due to increased traffic and more complex roadways. As a result, their crash rate is 17% higher than the average.

11%

"**Highway Cruisers**" are users with relatively high average speed and they represent 12% of the population. Although their phone manipulation behavior is similar to the City Dwellers group, their crash rate is 19% lower than average since they spend a lot of time on the highway where overall crash risk is lower.

12%

INFLUENCING BEHAVIOR TO IMPACT RISK

As these seven groups are very different both behaviorally and demographically, it's likely safe to assume their motivations are quite different, too. This unfortunately means a "one size fits all" approach to influencing behavior – such that it reduces risk – will be ineffective.

However, by better understanding the differences between the groups it will be possible to best tailor strategies and incentives for each specific user segment. For example, an insurer that wants to reduce the 76% higher than average risk for drivers in the "Phone Surfer" segment might design a game that rewards avoidance of texting while the vehicle is in motion, thus helping push those drivers into the Red-Light Reader group, with its 12% below average risk. While not eliminating phone use, it has the potential to show a dramatic impact on overall risk. Knowing that "Phone Surfers" skew younger, and show a preference for luxury vehicles, would further influence the marketing, game design and incentives.
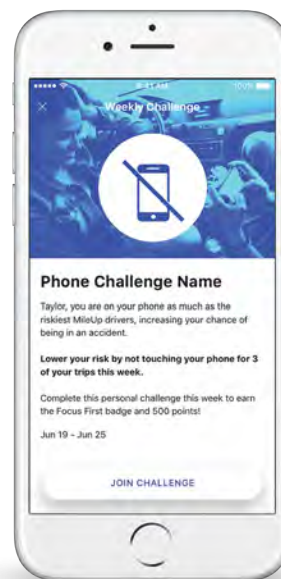

Source: Agero MileUp Challenge example

ONLY THE BEGINNING

These data insights are only one of many use cases for mobile telematics, and barely scratches the surface of what we can learn about – and how we can impact – drivers. It's the reason Agero is pushing hard every day to get its technology into the vehicles and pockets of more drivers, making a positive impact on road safety. With the richness of data from the Driver360™ mobile telematics platform, we can measure sources of risk, identify groups of users with different motivations, and better tailor products and services to help keep them and other drivers safer on the roads.

Agero's Driver360™ platform is an AI-powered mobile telematics platform derived from MileUp[1] technology. It enables a holistic accident solution and customer experience from crash detection and response to claim processing and prevention.

The platform features a capability that detects 95%+ of crashes with airbags deployed[1]; automatically notifies Agero's emergency contact center when an accident is detected; and provides GPS location to help emergency responders locate the accident scene.
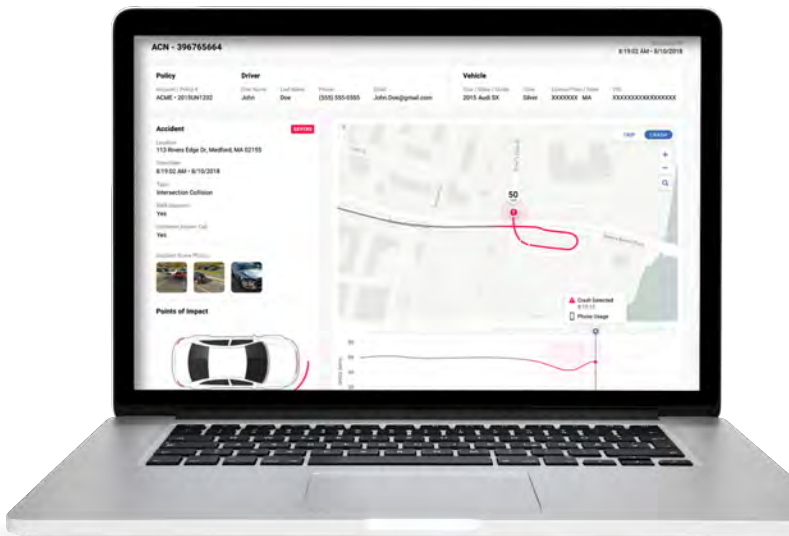
ABOUT THE AUTHORS

Michael Bell, PhD, *Director of Data Science and Analytics*

As a Data Scientist at Agero, Mike spends most of his time thinking about how to help drivers in need, whether their car has broken down or they've been in a crash. He and his team have developed algorithms for detecting crashes and risky driving behaviors using a smartphone, studied crash risk factors using billions of miles of driving data collected with the MileUp app, modeled demand for tow trucks and when they might arrive late, and much more.

ABOUT AGERO

Agero's mission is to safeguard consumers on the road through a unique combination of platform intelligence and human powered solutions, strengthening our clients' relationships with their drivers. We are a leading provider of driving solutions, including roadside assistance, accident management, consumer affairs and telematics. The company protects 115 million drivers in partnership with leading automobile manufacturers, insurance carriers and other diversified clients. Managing one of the largest national networks of service providers, Agero responds to more than 12 million requests annually for assistance. Agero, a member company of The Cross Country Group, is headquartered in Medford, MA, with operations throughout North America. To learn more, visit www.agero.com and follow on Twitter @AgeroNews.

References

[1] Performance based on MileUp user study from December 2016 to August 2017.

Dingus, T. A., Guo, F., Lee, S., Antin, J. F., Perez, M., Buchanan-King, M., & Hankey, J. (2016). Driver crash risk factors and prevalence evaluation using naturalistic driving data. Proceedings of the National Academy of Sciences, 113(10), 2636-2641.

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