New England University Transportation Center
77 Massachusetts Avenue, E40-279
Cambridge, MA 02139
617.253.0753
utc.mit.edu

Year 24 Final Report

Grant Number: DTRT12-G-UTC01

Project Title:

Cell Phones and Motor Vehicle Fatalities Final Report

Project Number:	Project End Date:	Submission Date:
HVDR24-14	1/31/16	1/15/16

Principal Investigator:	Daniel Shoag	**Co-Principal Investigator:**	Erich Muehlegger
Title:	Assistant Professor	**Title:**	Assistant Professor
University:	Harvard Kennedy School of Government	**University:**	University California Davis
Email:	Dan_Shoag@hks.harvard.edu	**Email:**	emuehlegger@ucdavis.edu
Phone:	617-495-7649	**Phone:**	617-335-6083

Description of the problem:
The research objective of this project is to explore how the use of mobile devices affects driver safety. With almost all American adults owning a cell phone and other mobile devices currently, cell phone use while driving is thought to be extremely common. There has been significant concerns raised about distracted driving; however relatively little consensus has been reached on the impact of distracted driving on safety.

Approach:
Academic studies employ a variety of approaches, from driver simulations to econometric estimates exploiting cell phone plan contract structure and reach an equally wide range of results, from estimates that suggest driver distraction and cell phone use increase accidents substantially to estimates that suggest cell phone use has little impact. But, to our knowledge, none of these studies directly observe primary data on cell phone use and match information with data on vehicle crashes or fatalities. We bring direct evidence to bear on this important public health and safety question by examining the relationship between accidents and directly observed data on cell phone call volumes at the local level.

For more than two thousand cell phone towers, we observe hourly call volumes as well as whether there nearby vehicle accident that led to a serious injury or fatality.

Methodology:
Our traffic accident data come from the national road safety authority of a mid-sized European country, and they include information on 3,548 accidents in 2006 and 3,155 in 2007. The data only record accidents involving serious injuries or deaths. The data include a detailed time stamp, a roadside location, and a description of the cause of the accident. We were able to successful geocode more than 70% of these accidents using Google's geocoding API. We match this dataset to a proprietary dataset of a nationwide mobile phone carrier for that same country. The data are call data records that contain the call time, duration and tower locations and scrambled identifiers for each recipient and caller. The carrier has roughly 15% market share, and the data set spans a 15-month period between 2006 and 2007, with the exception of a 6 week gap due to data extraction failures.

We collapse the data to tower-hour level, yielding a data set of 22.5 million observations. The average tower hour has 37.1 calls, but this distribution has a long right tail - the median tower hour features only 10 calls. In total, we have 2,056 unique towers in the data and 830 million calls. To estimate the results we match accidents to the nearest tower and construct outcomes for neighborhoods of fixed distances for each tower. Our unit of observation is thus the tower-hour, and we limit the sample to tower-hours with at least one call. Since multiple accidents rarely occur near the same tower in the same hour1, we use a dummy variable for whether or not an accident occurred within a particular distance from the tower as our dependent variable and estimate the following linear probability model:

$$Accident_{iht} = \beta LogCalls_{iht} + \varepsilon_{iht}$$

Where i denotes the tower, h denotes the hour of the week, and t denotes time

Effectively, we compare accidents near a particular tower in a particular hour of the week to the same tower and hour of week in other weeks. Our specification tests whether accidents are more likely at times when call volumes are high than when call volumes are low.

Findings:
We estimate that a 100% increase in call volume roughly corresponds to an increase in the probability of a major accident of 4.3%. This effect is slightly larger over the larger radius, and it is statistically significant at conventional levels at that distance. One concern with these results is that they fail to account for differences in congestion or traffic across tower-radii. To correct for that, we include fixed effects for tower and hour of the week. These controls should correct for bias due to baseline differences in road usage that do not change over time. We see in these columns that, while the precision of the estimates is somewhat weakened, we still see a sizable correlation between cell phone use and serious accidents.

These results are the first direct evidence linking call patterns and accidents in a non-experimental setting. As expected, the observational data strongly confirm the link between traffic injuries and death and mobile phone use.

Conclusions:
Though dozens of countries and multiple states have banned the use of mobile phones while driving, we are unaware of any prior direct evidence linking total cell phone usage volume to real-world accidents. This paper compliments a growing literature by documenting these associations in data in a non-experimental context and shows that the correlations are robust to a series of controls. This data also opens up a new window on the relationship between phone usage and accidents. Future research will explore heterogeneity in these effects, and disentangle the effects associated with incoming and outgoing calls. We believe that the data and framework established here provide a nice illustration of the research that can be done on humanitarian consequences of technology in social science.

Conference Presentations:
This paper was presented at the Humanitarian Technology 2015 conference in Cambridge, MA. Hum Tech 2015 provides a forum for scientists, engineers, field workers and policymakers to discuss current research and exchange technical ideas that advance global humanitarian action.