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Can Behavioral Interventions Be Too Salient?

Evidence from Traffic Safety Messages

By Jonathan D. Hall, University of Toronto; and Joshua Madsen, University of Minnesota

There is growing interest among academics and policymakers in using behavioral interventions as a low-cost and easy-to-implement way of encouraging socially desirable behaviors. Reflecting this interest, such interventions are used by over 200 governments and institutions to address a wide variety of issues, including voter turnout, charitable giving, retirement savings, water conservation, energy conservation, hand washing, caloric intake, diarrhea, and risky sexual behavior. Many of these interventions are expressly designed to get people's attention at a time when they can make the desired action. However, little thought has been given to individuals' cognitive constraints and to the possibility that seizing one's attention may crowd out other, more important, considerations. Our research shows, in a high-stakes context, that crowding out can occur and cause even a simple intervention to backfire with costly individual and social consequences.

Our context is a seemingly innocuous behavioral campaign with the stated objective of reducing traffic crashes, the leading cause of death for 5-to-45-year-olds in the United States and the world. This campaign displays the year-to-date count of roadside fatalities on available dynamic message signs (DMSs) (e.g., "1,669 deaths this year on Texas roads"). These fatality messages are expressly designed to be salient, with official statements expressing the "hope" that these "in your face" safety messages will "motivate motorists to exercise caution behind the wheel" and that a "sobering new message . . . will help save lives." Because of its low cost and ease of implementation, this campaign has spread to at least 27 states since 2012 and has affected at least 90 million drivers.

This campaign is widely believed to be effective. For instance, in Illinois the decision to start showing fatality messages was unanimously supported by the Department of Transportation, state police, and Department of Public Health. Drivers also believe that fatality statistics make safety messages more effective. Belief in the effectiveness of these messages is likely an additional factor in their rapid spread. We find, in sharp contrast to these expectations, that this campaign is increasing the number of traffic crashes.

One key challenge when measuring the effect of fatality messages is that they are frequently displayed during safer times when the DMS is not being used for more-pressing concerns (e.g., travel times or crash alerts), biasing any naive analysis toward finding a lower frequency of crashes when fatality messages are displayed.

The state of Texas provides a unique setting to overcome this challenge. Unlike most states, the Texas Department of Transportation (TxDOT) displays the current fatality count only one week each month: the week prior to TxDOT's

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monthly board meeting. Since August 2012, TxDOT broadcasts the fatality message on as many DMSs as possible during this week. While other messages can preempt the fatality message, traffic engineers are instructed that along corridors with a large number of DMSs, "the fatality message should be displayed on a few [DMSs]." We confirm that fatality messages concentrate in the designated weeks and use this treatment to estimate the effect of fatality messages on traffic crashes.

We estimate the effect of showing fatality messages, relative to the status quo usage of DMSs, by comparing how the number of crashes on road segments downstream of a DMS differs the week prior to a TxDOT board meeting (that is, a campaign week) relative to the same segments the rest of the month. We conduct our analysis at the segment-hour level and control for inherent variation across different segments over time and throughout each day. As such, our estimates compare, for example, the number of crashes within 10 km downstream of a DMS from 2:00 to 3:00 p.m. on Thursday, July 18, 2013, which occurs during the week prior to a board meeting, with the number of crashes on the same segment from 2:00 to 3:00 p.m. on the other three Thursdays in July 2013. We find that during treated weeks, there are, on average, 1.7 percent more crashes over the first kilometer after DMSs, diminishing to 0.8 percent more crashes over 8–10 km after DMSs. We conduct two placebo tests to address the possibility that the weeks prior to TxDOT board meetings are inherently more dangerous than other weeks within the same month. First, we estimate the change in crashes occurring upstream of DMSs. As a segment can be upstream of one DMS and downstream of another, we restrict this test to DMSs where the nearest upstream DMS is more than 10 km away. Second, we estimate a placebo effect using data from the pretreatment period. Both tests produce statistically and economically insignificant placebo effects.

Our main results exploit both within-month variation for when fatality messages are instructed to be displayed and differences between the pretreatment (January 2010–July 2012) and treatment (August 2012–December 2017) periods. We find that during treated weeks there are 1.35 percent more crashes over the 10 km after DMSs. These results suggest that, inconsistent with the policy's stated objective, using fatality messages to increase awareness of the risks of driving increases the number of traffic crashes.

The magnitude of the effect is large given the simplicity of the intervention. The above estimates measure the effect of the assignment to show a fatality message. Because of imperfect compliance, we use an alternative strategy to estimate the effect of displaying a fatality message. We find that displaying a fatality message increases the number of crashes over the 10 km downstream by 4.5 percent. Based on prior research, this is comparable to raising the speed limit by 3–5 miles per hour or reducing the number of highway troopers by 12–14 percent. Our back-of-the-envelope calculations suggest that fatality messages cause an additional 2,600 crashes and 16 fatalities per year in Texas alone, with a total social cost of $377 million per year.

Our proposed explanation for this surprising finding is that fatality messages add to drivers' cognitive loads, temporarily interfering with their ability to respond safely and quickly to changes in traffic conditions (e.g., staying in lane, maintaining proper distance, or responding to a vehicle changing lane). We provide several pieces of evidence that support this hypothesis. First, we find that fatality messages are more harmful when they report a larger number of fatalities (i.e., a plausibly more shocking and distracting number). In a related test, we find that as the year progresses, and the number of displayed fatalities increases, the effect worsens, with the largest number of additional crashes occurring in January (when the fatality number is the highest). As further evidence, we find that the increase in crashes concentrates in areas where drivers' cognitive loads are already high, as proxied for by annual vehicle kilometers traveled, downstream lane kilometers, downstream centerline kilometers, or the presence of multiple DMSs. We also find that fatality messages increase the number of multivehicle crashes but not single-vehicle crashes, consistent with increased cognitive loads causing drivers to make small mistakes, such as drifting out of their lane, rather than large errors, such as driving off the road. The decreasing effect size over longer distances is also consistent with a temporary distraction effect. Finally, vehicle simulator studies of billboards and driver anxiety are consistent with fatality messages causing a temporarily reduced ability to drive safely.

In contrast, when cognitive loads are low or the message is less distracting, fatality messages plausibly help or have no effect. We find that showing a fatality message helps when fatality counts are below the 25th percentile or when our measures of complexity are well below their means.

It is possible that fatality messages distract drivers in the moment but then lead them to drive more safely either elsewhere or later in the month. We find evidence suggesting that this is not the case. First, drivers do not drive more safely the days immediately following campaign weeks. Second, drivers are not getting used to the messages. Fatality

messages are associated with an increase in crashes every year, except one, between 2013 and 2017. Finally, drivers do not drive more safely elsewhere during treated weeks. We estimate that during treated weeks there are 1.98 percent more crashes statewide, primarily driven by increased highway crashes. We also rule out several alternative explanations, including the possibility that reading a message (rather than the message's content) causes the crash and the possibility that the reported number of fatalities is less than drivers expect, causing drivers to respond rationally by driving more recklessly.

NOTE:

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